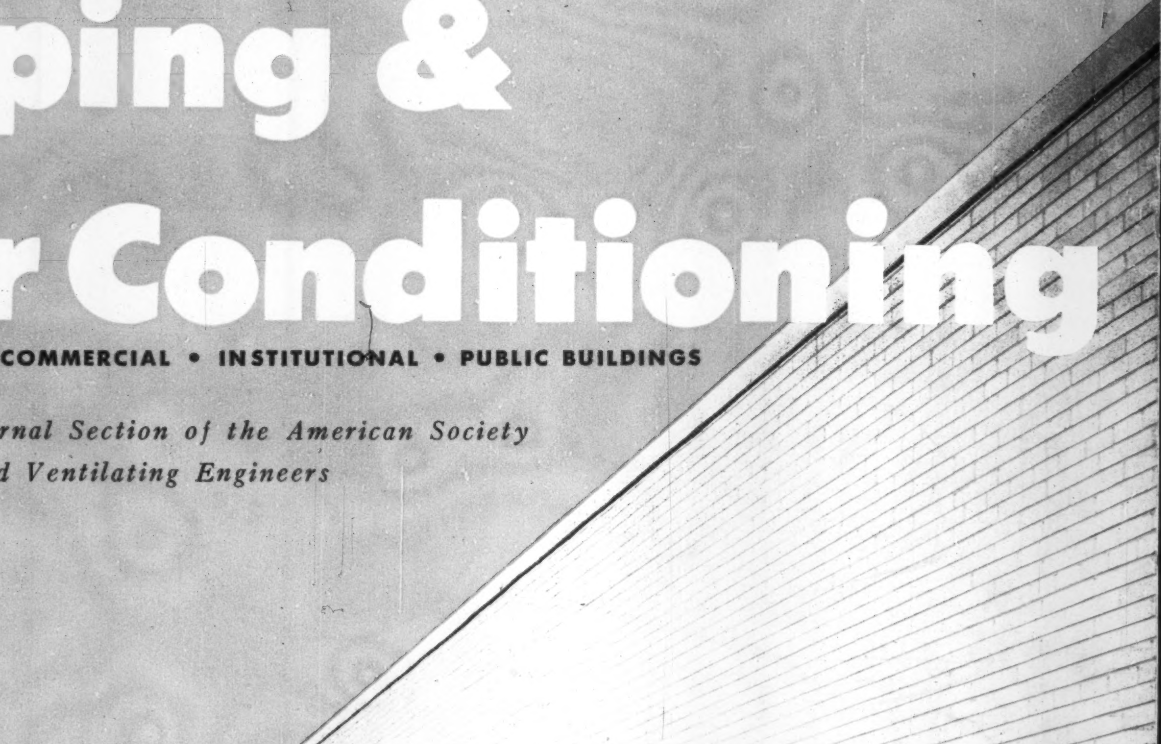
Heating Piping & Air Conditioning

SEPTEMBER 1954

INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

Page 133—Journal Section of the American Society of Heating and Ventilating Engineers



New Windowless Air Conditioned Plant .... Page 89

New TVA's Steam Plant Piping Design 100

Heating Costs Reduced In Two Installations ...106

Controlling Uranium Dust 109

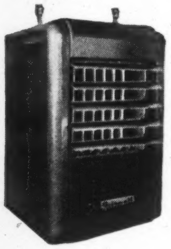
Complete Contents of This Issue ...5

HEAT

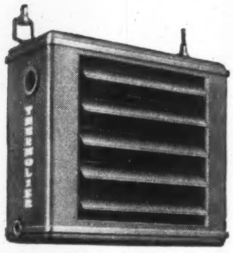
where you want it
when you want it

whatever the fuel you use

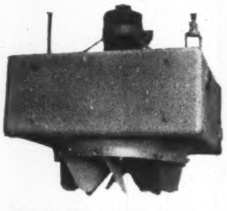
GRINNELL UNIT HEATERS



Horizontal Gas-Fired Model for natural, manufactured, mixed and LP Gases.



Horizontal Model for steam and hot water systems.



Vertical Model for steam and hot water systems.

Grinnell quality is well known. The "Grinnell" name is backed by over 60 years of heating experience. Regardless of the type and model you choose, you can depend on a Grinnell Unit Heater to give balanced heating performance plus maximum fuel economy. Call on Grinnell . . . for the unit heater to meet your specific needs.

GRINNELL
Gas-Fired Unit Heater

Available in 7 sizes — ranging from 25,000 to 200,000 Btu per hour input

Grinnell Gas-Fired Unit Heaters are easy to install, simple to operate and maintain. Efficient performance is assured — with any type of gas — by modern design of burners and heat exchanger, proper motor and fan unit. Automatic safety pilot operates to shut off main gas supply if pilot goes out. Flashback and extinction noise prevented by the burners' raised port design and proper port size for the gas used. American Gas Association approved.

GRINNELL THERMOLIER
Steam/Hot Water Unit Heater

4 models . . . 18 sizes — from 35,600 to 275,300 total heat delivered, Btu per hour

Three basic models—horizontal, vertical and a special horizontal Textile model. (Adjustable velocity nozzle also available for use on horizontal models.) All models have plain thermostatic trap, the simplest and least expensive kind of a trap, made practical because of unit's exclusive internal cooling leg; maximum capacity provided and destructive water hammer eliminated by built-in pitch of tubes. Many other important features.

GRINNELL
WHENEVER PIPING IS INVOLVED

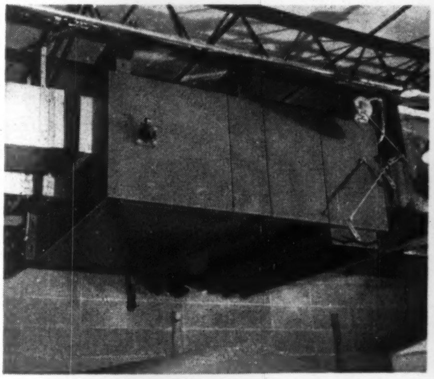
Grinnell Company, Inc., Providence, Rhode Island • **Coast-to-Coast Network of Branch Warehouses and Distributors**

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

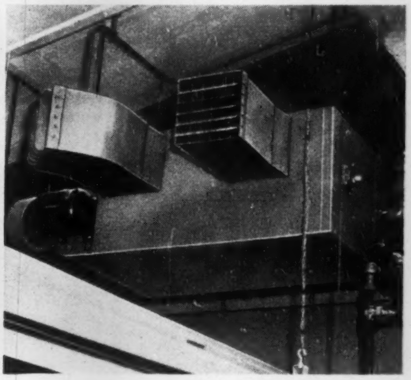
BH Type Heating and Ventilating Units solve large-space conditioning problem

Low cost installation and operation were the most important factors in the decision to install usAIRco's BH Type Heating and Ventilating units for Vandercook & Sons, Chicago manufacturer.

usAIRco BH Type Heating and Ventilating Units are adaptable to every job . . . co-ordinated sectional construction makes a limitless number of arrangements possible. Available sections include: blower, air intake mixing chamber, face and by-pass damper, by-pass duct, filter and coil sections. Floor or wall mounting is also possible. Available in 8 sizes, 1,200 cfm to 32,000 cfm. Contractor for Vandercook & Sons installation: W. A. Pope Co. Heating, Chicago. Architects: Johnson & Johnson, Chicago.



To heat this large factory area, 350 feet by 210 feet, with a 35-foot ceiling, 14 BH-210 units (5,000 cfm. 300,000 BTU) and two BH-212 units (6,750 cfm. 405,000 BTU) were suspended from the ceiling. Both are horizontal type with cowls.



To heat and ventilate the two lavatories, two BH-210 units with fresh air supply intakes were installed. Both units are equipped with non-freeze steam distributing coils and throw-away filters. Ductwork, before and after, serve air distribution.

for descriptive literature on BH units write Dept. HP 94

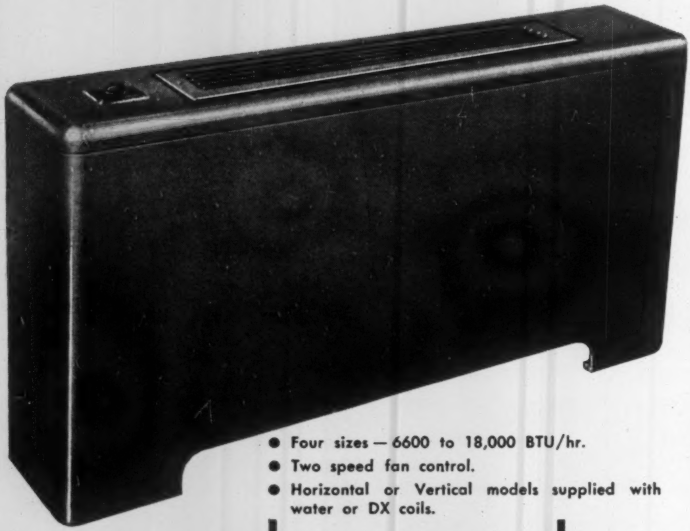
UNITED STATES AIR CONDITIONING CORPORATION

MINNEAPOLIS 14, MINNESOTA

usAIRco

30 YEARS OF AIR CONDITIONING

There's a Treasure Waiting for You



- Four sizes — 6600 to 18,000 BTU/hr.
- Two speed fan control.
- Horizontal or Vertical models supplied with water or DX coils.

You don't have to dig up applications for BUSH Remote Air Conditioning Units. They're everywhere: hotels, motels, hospitals, office buildings . . . all types of multi-room installations.

The spade work's been done. Owners and executives realize that year 'round air conditioning is a *must*. They readily recognize BUSH units as the answer to their needs.

Prospects will appreciate your presenting the practical, "sell-themselves" features of these handsome units. They'll especially like the shallow depth front to back that permits full use of room space . . . the low noise level and quiet operation . . . the fact that fan, motor and drain pan is one complete assembly — eliminating the necessity of any "in-the-room" fussing during cleaning or maintenance.

Chart your course to greater profits now . . . request free descriptive literature.

BUSH MANUFACTURING COMPANY
WEST HARTFORD 10, CONNECTICUT

BUSH

Heating Piping & Air Conditioning

Vol. 26 No. 9

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

BOARD OF CONSULTING AND CONTRIBUTING EDITORS . . . .

N. R. Bernz, Leo F. Collins, Sabin Crocker, R. C. Doremus, Philip Drinker, M. K. Fahnestock, Walter L. Fleisher, William Goodman, William A. Hanley, G. W. Hauck, R. S. Hawley, E. P. Heckel, R. E. Hieronymus, J. C. Hornung, Lee P. Hynes, C. W. Kimball, Dwight D. Kimball, A. C. Kirkwood, Charles S. Leopold, Samuel R. Lewis, H. C. Murphy, Alfred J. Offner, F. B. Rowley, Robert P. Schoenijahn, Kalman Steiner, T. S. Tenney, Rush D. Touton, Eph A. Tyler.

EDITORIAL DIRECTOR .... C. M. BURNAM, JR.

EDITOR .... ROBERT W. ROOSE

ASSISTANT EDITOR .... GLENN A. NEWBERRY

ASSISTANT EDITOR .... F. A. HENKIN

ASSISTANT EDITOR .... M. C. WRIGHT

ADVERTISING STAFF . . . .

Wallace J. Osborn and Robert J. Osborn, New York—Murray Hill 9-8293 . . . . Robert A. Jack and David V. Mahan, Cleveland—Evergreen 2-1840 . . . . James D. Thomas, George C. Cutler, Thomas V. Johnson and James E. Sacra, Chicago —State 2-6916 . . . . R. P. Wettstein, Los Angeles—Dunkirk 8-2286, Portland—Atwater 4107, San Francisco—Yukon 6-2522

CHAIRMAN OF THE BOARD and PUBLISHER .... FRANK P. KEENEY
PRESIDENT and GENERAL MANAGER .... CHARLES E. PRICE

CIRCULATION DIRECTOR ..... FRANK S. EASTER

PRODUCTION MANAGER .... LAWRENCE A. DOYLE

Published monthly by the Keeney Publishing Co., 6 N. Michigan Ave., Chicago 2, Ill. Telephone: STate 2-6916. Subscriptions: U.S. and possessions, $3.00 per year; Canada, Cuba, Mexico, Central America, South America, $4.00 per year; other, $6.00. Current copies, U.S. and possessions, 35c each; back copies, 60c each. January 1954 issue $1.50 per copy. For change of address, notify publisher and your local postoffice of both old and new addresses by the 8th of the preceding month. Member Audit Bureau of Circulations, Associated Business Publications, Inc., and Magazine Publishers Association, Inc. Heating, Piping & Air Conditioning is indexed regularly by Engineering Index, Inc., and Industrial Arts Index and is microfilmed by University Microfilms. Copyright 1954 by the Keeney Publishing Co. Entered as Second Class Matter May 18, 1929 at the postoffice at Chicago, Ill., U.S.A. under the Act of March 3, 1879. Additional entry at Mendota, Ill.

SEPTEMBER 1954

Features

New Windowless Air Conditioned Plant 89
D. R. Dooley
How To Hook Up Refrigerant Piping 92
Lincoln R. Scafe
Up In the Air Heating and Cooling System 95
T. E. Trese
Steam Vacuum Refrigeration 96
Elliot Spencer
Experience Is Still the Best Teacher 99
says Wray M. Scott
New TVA Steam Plant's Piping Design 100
Roy E. Lyon
Heating Costs Reduced In Two Installations 106
D. B. Tuxhorn
Controlling Uranium Dust 109
H. I. Miller, Jr.
Low Pressure Steam 114
cools and heats plant
How To Calculate Air Washer Performance 116
H. M. Hendrickson
How Much Damage Can Piping Do? 126
Bill Dopp

***Also*:**

United Association Apprentice Contest 86
Air Conditioning Comes To Sam Houston Coliseum 94
Heat Pump Air Conditions Power Co-op Year Around 98
How Scientific Color Choice Beats the Heat 104
ASRE Convention Highlights 105

Departments

The Editors' Pages 77
News notes and comment
"Open for Discussion" 83
Letters to the editors
Sam Lewis' Page 122
Tapping the Hot Water Boiler
On the Job 123
How 324 Fans Cool Reduction Pots
The Law and Your Profits 124
William Hurd Hillyer
Question of the Month 125
How Prevent Piping Corrosion?
Practical Piping Problems 126
"Mac" helps a friend
Data Sheet 130
Solar Irradiation of Walls and Windows

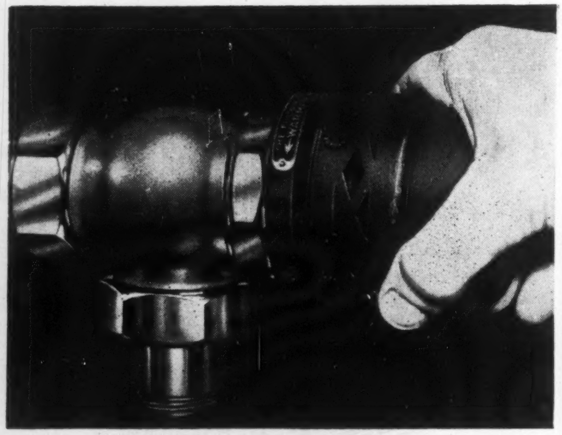
***Also*:**

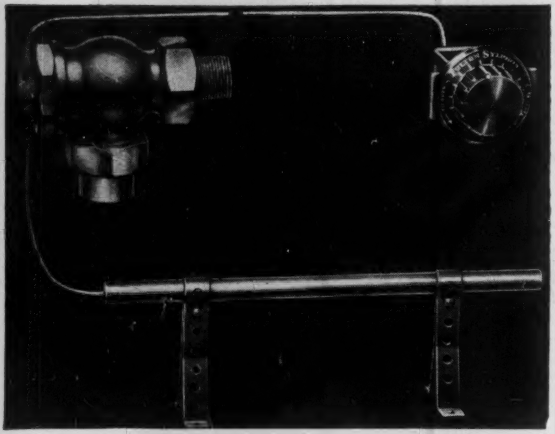
Equipment Developments 237
Recent Trade Literature 254
Who's What 268
We Hear That 282
New Books and Reports 290
Meetings and Conventions 294
Index to Advertisers 306

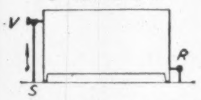
ASHVE Journal Section

Effect of Room Size on Panel Performance 133
L. F. Schutrum and J. D. Vouris
Downward Heated Air from a Vertical Unit Heater 141
Linn Helander, S. M. Yen and L. B. Knee
ASHVE Chapters 153
L. N. Hunter
Proceedings of Semi-Annual Meeting 154
What We Are Doing About Air 160
Research page
Hotchkiss and Vidulich Join Staff 161
Summary of Chapter Meetings 165
Candidates for Membership 166
Officers, Council and Committees 168

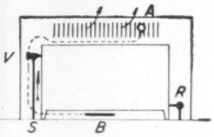
Illustrated—two basic types of Sylphon automatic radiator valves. Right, for exposed radiators. Left, for enclosed radiators. Both available in angle and globe bodies.







No. 885 on exposed radiator



No. 895 on concealed radiator

SIMPLIFIED SYSTEM *for low-cost room comfort!*

Sylphon Automatic Radiator Valves provide a simple, efficient way to get greater room comfort at lower cost—all winter long. See how effectively—how economically—they do the job.

1. These easily adjustable radiator valves assure uniform temperature control at all times—whether it's in one room, a large office or an entire building. Temperature is *kept* even. No discomfort. Result—comfort conditions and occupant efficiency are improved.

2. They substantially reduce heating costs. For studies show that during 95 per cent of the average winter season, more heat is generated than needed for healthful comfort. With Sylphon Automatic Radiator Valves controlling temperature to meet requirements, fuel is saved.

3. They cost less than any other automatic controlling system available. Easily and quickly installed on your present radiators. Simply constructed, self-powered and packless, they are self-contained and fully modulating. They pay for themselves many times over in fuel savings alone. For complete information, send for Bulletin RH-80.

Robertshaw-Fulton ®
CONTROLS COMPANY

FULTON SYLPHON DIVISION • KNOXVILLE 1, TENN.

COLORADO COLLEGE FOUNDED 1874
at 6,036 feet above sea level . . .
SPANG CW

. . . top quality service from SPANG® "CW" STEEL PIPE

Colorado College, founded in 1874 at Colorado Springs, is the oldest college in the state. Daily temperatures around this area, situated over a mile above sea level in the Rocky Mountains, vary on an average of 30°F, and put more than ordinary service requirements on a heating system.

This temperature variation was taken into consideration when the college's new men's dormitory was planned. A dependable, all-season heating system was needed, and SPANG CW Steel Pipe was specified for the installation . . . not only for heating, but for the plumbing system as well in this 94-room building.

Why is SPANG CW considered tops in its field? The answer is **quality control**. Only *top-quality* skelp goes into the making of SPANG CW. Close control is maintained during forming. The finished pipe is thoroughly tested and inspected before shipment. Such care in pipe-making at SPANG assures users of *top-quality* pipe that is easy to cut, bend, thread and weld . . . and this means faster, lower-cost installations.

SPANG CW Steel Pipe is your best bet for every type of plumbing, heating, air conditioning, radiant heating and snow melting installation. You can get *top-quality* SPANG CW from your local SPANG Distributor. And he will give you *top-quality* service, too!

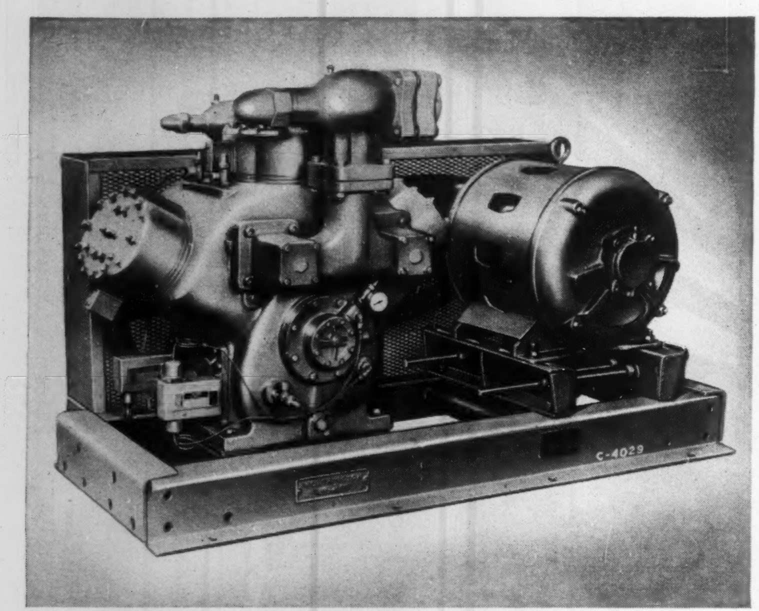
Owner: **Colorado College, Colorado Springs**
Architects: **Edward L. Bunts, A.I.A.; F. Lamar Kelsey, A.I.A., Colorado Springs**
Contractor: **M. W. Watson, Topeka, Kansas**
Plumbing and Heating Contractor: **Benbow Plumbing & Heating Co., Colorado Springs**
SPANG Distributor: **Colorado Springs Supply Co., Colorado Springs**

SPANG-CHALFANT

DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Office: Two Gateway Center, Pittsburgh, Pennsylvania District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis.

The whole industry's talking about Worthington's new Freon compressor



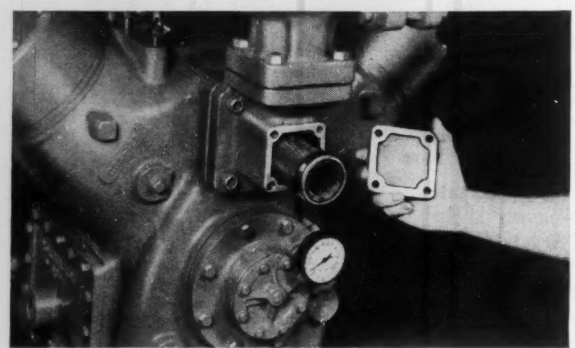
TRIM, STURDY CONSTRUCTION marks this 4JF6 compressor unit — 50-60 hp, six cylinder W-type compressor. The complete compact unit consists of fabricated steel base, compressor with valves, gauges and safety controls, drive and safety guard. Designed to operate in conjunction with Worthington evaporative condensers in localities where city water is scarce or high in cost. Also available with shell and tube condenser. Complete range from 3-150 hp.

"The high capacity unit we've been waiting for!"

"Greater operating efficiency!"

"There's nothing else like it!"

And every comment you hear is true! The refrigeration compressor is the most vital element of any air conditioning or refrigeration system. That's why Worthington spent years in developing the new "J" Freon compressor. That's why Worthington invested over a million dollars in compressor research. *And that's why you can't find its match in any other unit.* Only a few features of the new "J" Freon compressor are highlighted here — get the full story by contacting your nearest Worthington district office or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.4.33, Harrison, New Jersey.



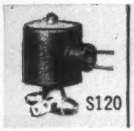
EASY REMOVAL of suction gas strainer for cleaning is made possible by new suction manifold design. No pipes, valves or other parts need to be dismantled in order to get at the strainer. And Worthington's new electric unloaders automatically balance power consumption with load requirements.

LORD & TAYLOR'S new West Hartford, Conn., store depends on Worthington to provide comfortable air conditioning for its customers. Two 150 hp "J" compressors and two evaporative condensers make up the highly efficient Worthington air conditioning team at this modern store.

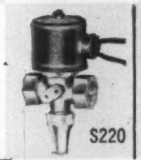
A.4.33

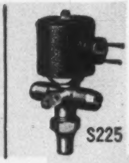
WORTHINGTON

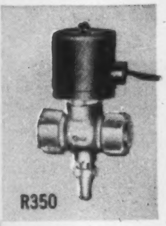
CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME


S120

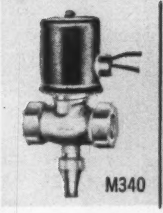
S115

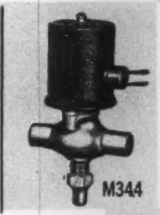

S220


S225


R350

ALCO
SOLENOID VALVES

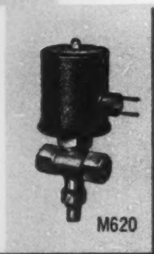

M340

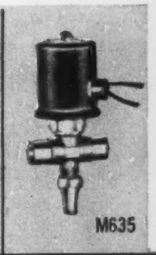

M344

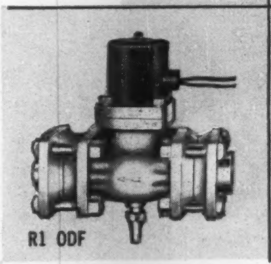
the complete line

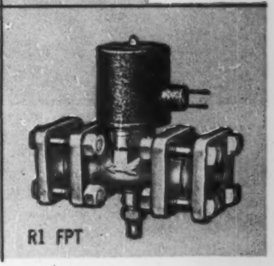
- **for** Freon-12, Freon-22, Methyl Chloride and Ammonia
- **for** liquid line, suction line or hot gas discharge service
- **for** brine, water, steam, air, oil
- **for** all types of electric current
- **for** wide range of connections: ½″ to 2⅝″ solder, ⅜″ to 2″ pipe thread
- **for** use with thermostats, float switches, timers, and many other control devices

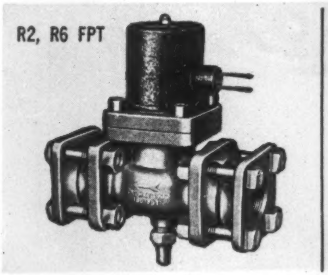
Special valves for special applications are available.

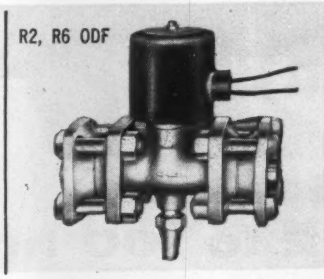

M620


M635


R1 ODF


R1 FPT

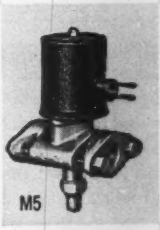

R2, R6 FPT

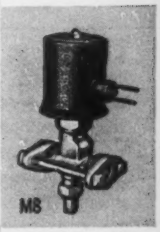

R2, R6 ODF

M91F

Our Bulletins 173 and 182 give complete technical information. Send for your free copies today.

SEE YOUR ALCO WHOLESALER


M5

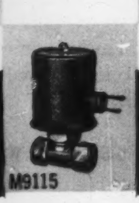

M8

ALCO

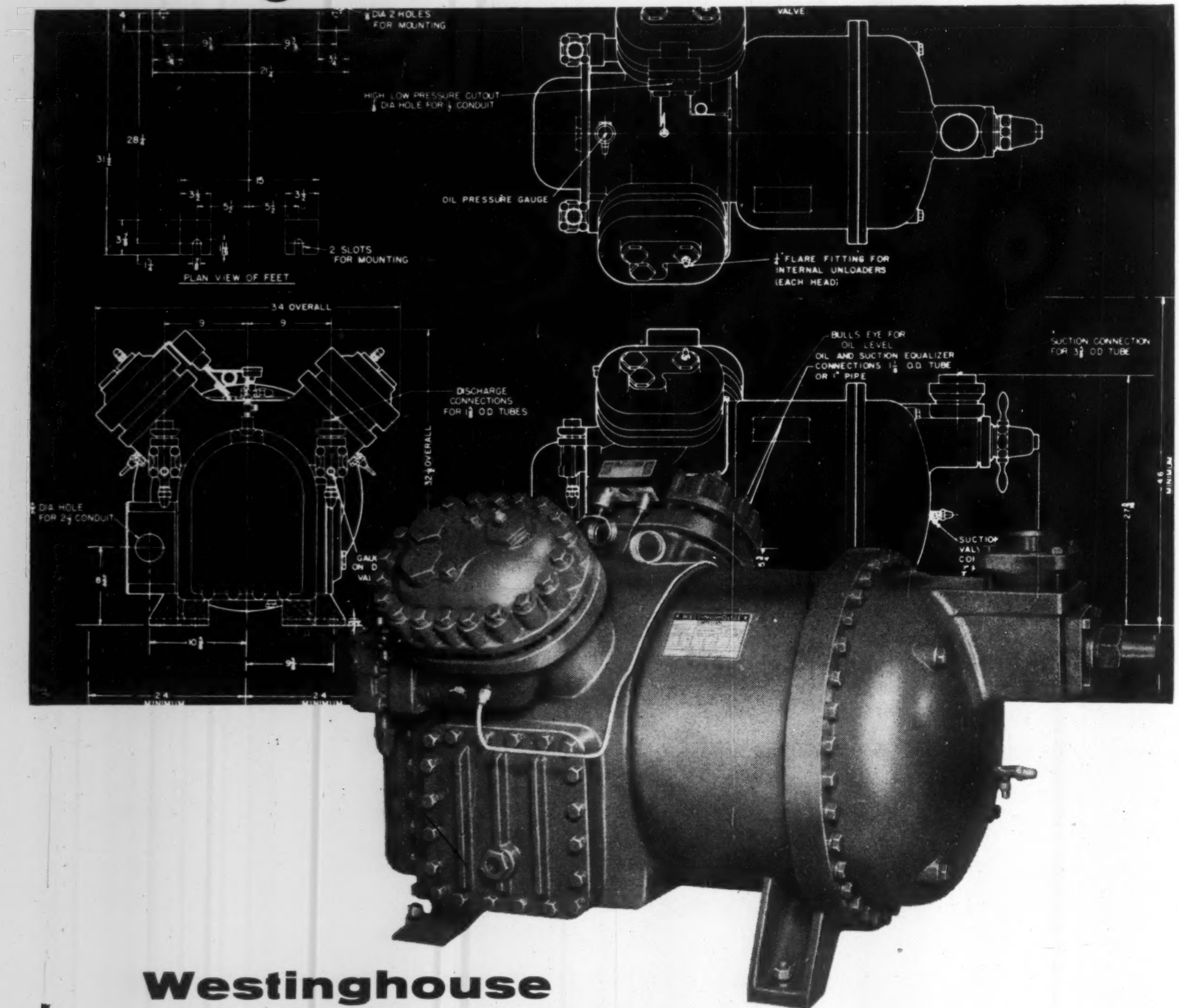
ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

5686


M9115

Design for Profit


DIA 2 HOLES FOR MOUNTING
VALVE
HIGH LOW PRESSURE CUTOUT
OIL PRESSURE GAUGE
2 SLOTS FOR MOUNTING
PLAN VIEW OF FEET
FLARE FITTING FOR INTERNAL UNLOADERS (EACH HEAD)
34 OVERALL
DISCHARGE CONNECTIONS
BULLS EYE FOR OIL LEVEL
OIL AND SUCTION EQUALIZER CONNECTIONS
SUCTION CONNECTION
24 MINIMUM

Westinghouse Hermetically-Sealed Compressors 2 to 100 hp

Capitalize on Westinghouse advanced compressor engineering. Easier to sell, easier to install and easier to service, the Westinghouse compressor line meets every market need—and has unmatched market acceptance. It is precision-built to provide low operating cost, long life and trouble-free operation. The refrigerant-cooled integral *motor* needs no ventilation. Belts, pulleys and shaft seals are eliminated. Moreover, size and weight are kept to a minimum—to lower installation costs.

Call the franchised Westinghouse Air Conditioning Distributor in your classified phone book, or write: Air Conditioning Division, Westinghouse Electric Corporation, Hyde Park, Boston 36, Mass.

WESTINGHOUSE AIR CONDITIONING

YOU CAN BE SURE...IF IT'S Westinghouse

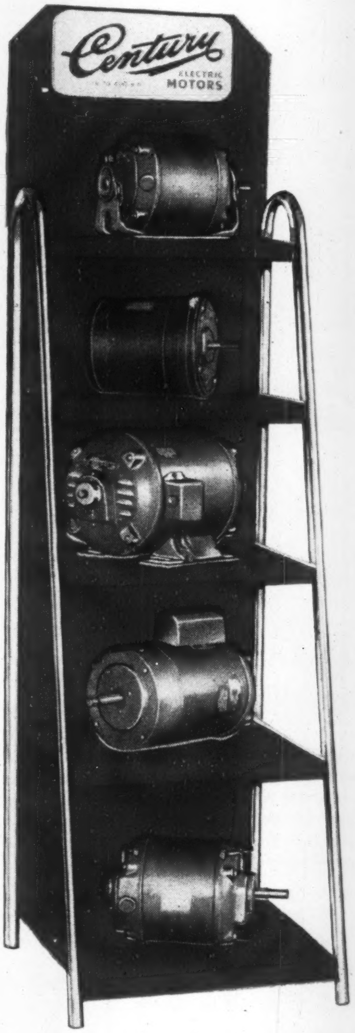
J-80388

Now from Century

TWO EASY WAYS TO GET YOUR SHARE OF PROFITABLE MOTOR REPLACEMENT BUSINESS

SELL MOTORS ON SIGHT WITH THIS

Century Silent Salesman



Take advantage of the BIG, constantly growing demand for replacement motors with these and other motors from the Century Line.

① MAINTAIN YOUR OWN MODEST STOCK OF *Century* MOTORS FOR RESALE

- Most often, when folks need a replacement motor, they need it QUICK. You can fill that need—and gain their loyalty—by selling them top quality motors from *Century's Complete Line.*
- A stock of Century Motors prepares you for profitable replacement business with most makes of compressors, oil burners, blowers, unit heaters, pumps, fans, appliances, and scores of other motor-driven products.
- Free, with your order for only ten Century Motors, you get the attractive red and chrome metal display stand shown here. It identifies you as the man to see for replacement motors. You'll show more motors, sell more motors with this display, in just a few square feet of space. Limit of one display stand per customer.

② WORK CLOSELY WITH YOUR COOPERATIVE *Century* SERVICE STATION

- Century's network of service stations is nation-wide. There's one in your vicinity—ready to give you delivery on practically any Century Motor your customers might need.
- Every Century Service Station is staffed by men whose skill you can use to solve your motor service problems . . . men who can help you get more profitable motor replacement business.

CENTURY ELECTRIC COMPANY St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

GET ALL THE DETAILS of the CENTURY Motor Selling Plan

...MAIL THIS COUPON TODAY!

Century C MOTORS

837

CENTURY ELECTRIC COMPANY
1806 Pine Street, St. Louis 3, Missouri

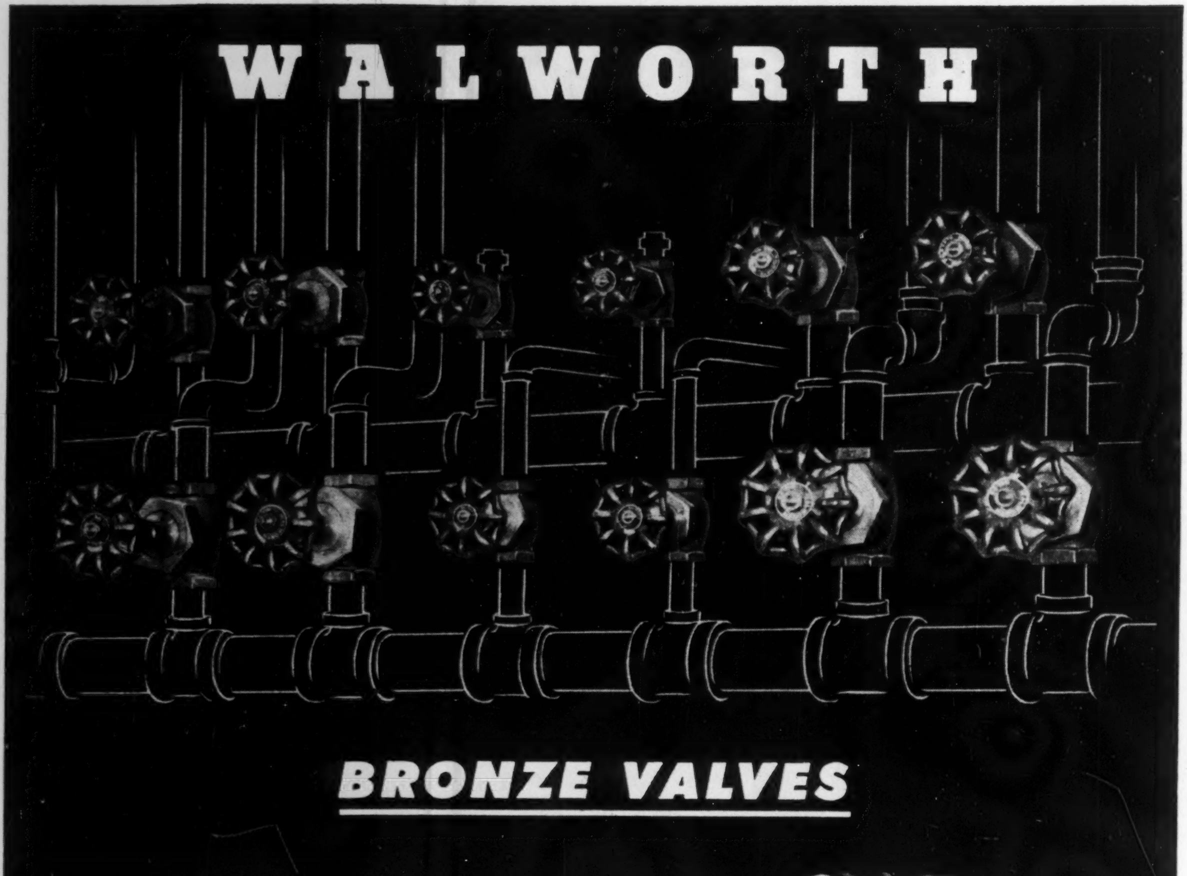
I want all the facts about Century's motor replacement selling plan.

Name..........

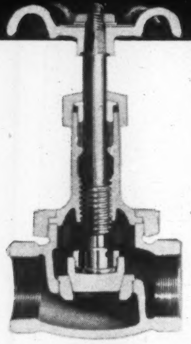
Company..........

Address..........

City.......... Zone.......... State..........



Better because ... **Walworth has standardized its line of bronze valves to provide an unsurpassed system of interchangeability of parts for assembly or replacement. You can maintain a great number of Walworth Bronze Valves with a small inventory of basic parts . . . you minimize part replacement problems. For further information, ask us for our Bronze Valve Standardization Chart.**



Parts are carefully machined and finished to close tolerances, thereby assuring accurate fit and alignment under all conditions. Sectioned valve is Walworth No. 225P *Bronze Globe* Valve with stainless steel plug-type seat and disc, heat-treated to a minimum of 500 Brinell hardness.

Choose from complete lines of Walworth Bronze Valves — including gate, globe, angle, check, and lubricated plug types. Walseal® Bronze Valves and Fittings are also available for making silver-brazed joints.

For full information on Walworth Bronze Valves and Fittings, call your Walworth Distributor, nearest Walworth Sales Office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, N. Y.

WALWORTH
Manufacturers since 1842
valves . . . pipe fittings . . . pipe wrenches
60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

COUNT ON 25 YEARS OF ECONOMICAL SERVICE

from a

PREFERRED

UNIT STEAM GENERATOR

Preferred Unit Steam Generators are available in sizes from 20 to 600 B.H.P. and pressures from 15 to 250 psi, to burn oil, gas or in combination

All units are factory fire-tested before shipment.

Because of the economies it realizes in low overall operating and maintenance costs, a Preferred installation pays for itself in *five years or less,* amortization included. Yet it gives 25 years expectancy of sustained high thermal efficiency (80% or more) over the entire range of load demand. Thus, four-fifths of the life of the installation costs you nothing!

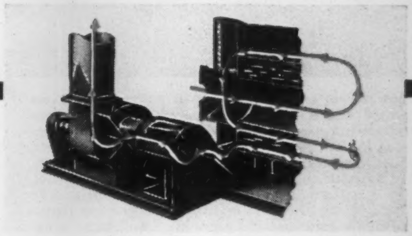
10 DESIGN FEATURES ARE THE REASON

Incorporated in the Preferred Unit Steam Generator are ten design features which make possible the remarkable record of this "packaged" boiler. Other makes may have some of these features, but only the Preferred has ALL TEN. They are combined to assure lowest cost steam generation by cutting fuel consumption by 10% or more and, above all, by cutting to a minimum such maintenance costs as refractory repairs, tube cleaning and corrosion-caused replacements. Although hundreds of Preferred Generators are in daily operation, there has never been a single case of furnace loss. There has never been a single loss of a pressure vessel.

The inter-related functions of Preferred's ten design features are discussed in Bulletin 2000. You'll find it interesting and profitable to study. Write for a copy.

PREFERRED UTILITIES MFG. CORP.

1860 BROADWAY, NEW YORK 23, N. Y.
DEPARTMENT SH-3

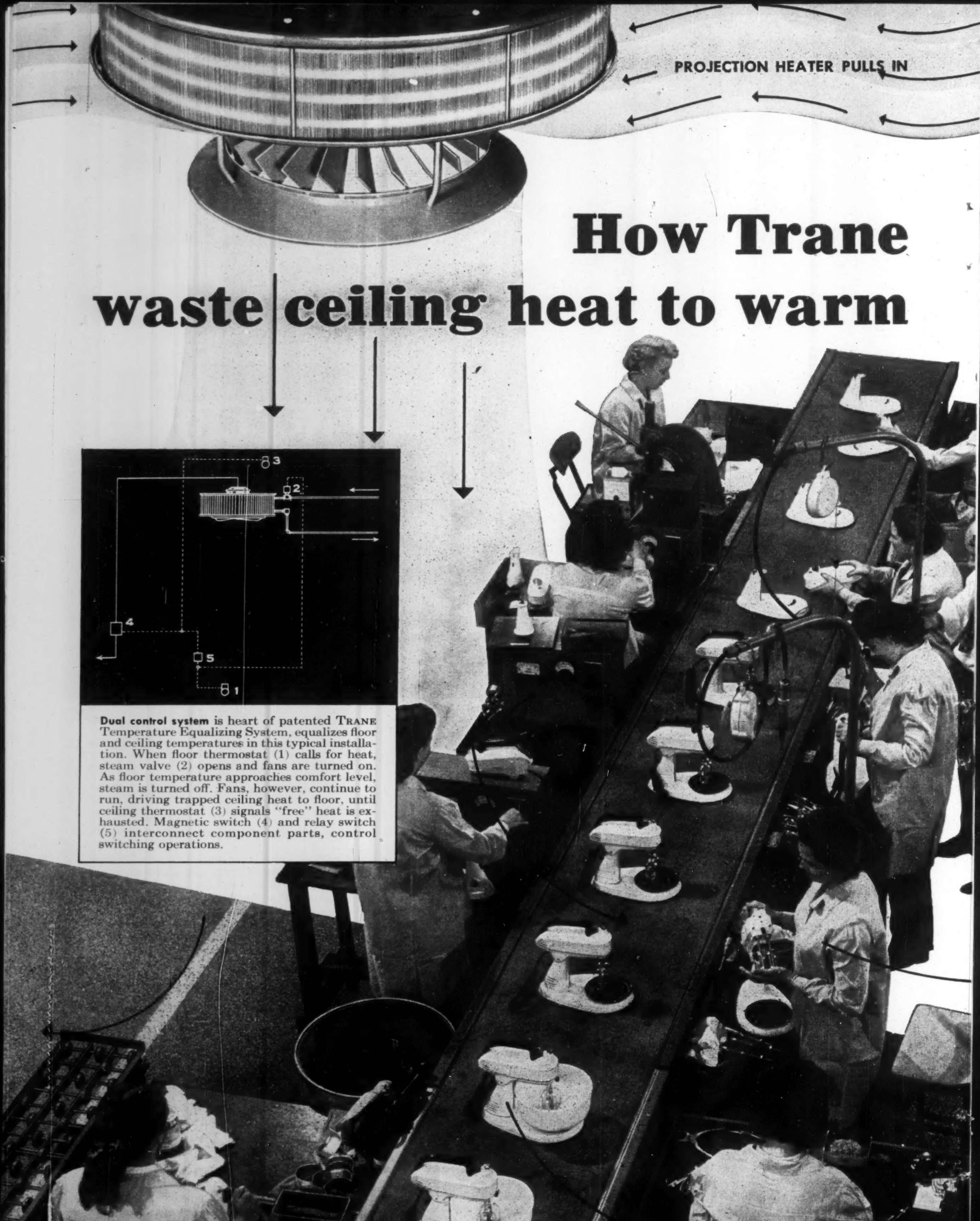


EXPANSILE PRECIPITATOR

Holds and contains entrained non-combustibles and insures clean, smokeless operation. It makes possible the maintenance of maximum gas velocities in all tubes at all times by preventing the build up of deposits, particularly at the last pass.

The Expansile Precipitator is one of the 10 design features which insure long service life and low overall maintenance and operating costs. Here are the other nine . . .

- Five Sq. Ft. of Heating Surface per Boiler HP
- Four Pass Gas Travel
- Down Draft Design
- Induced Draft
- Intermediate Furnace Position
- Anti-Stress Deck
- Staggered Tubes
- Dual Purging Action
- Full Automatic Oil and/or Gas Burners



How Trane waste ceiling heat to warm

Dual control system is heart of patented TRANE Temperature Equalizing System, equalizes floor and ceiling temperatures in this typical installation. When floor thermostat (1) calls for heat, steam valve (2) opens and fans are turned on. As floor temperature approaches comfort level, steam is turned off. Fans, however, continue to run, driving trapped ceiling heat to floor, until ceiling thermostat (3) signals "free" heat is exhausted. Magnetic switch (4) and relay switch (5) interconnect component parts, control switching operations.

WARM AIR TRAPPED BY HIGH CEILING, PUSHES IT BACK TO FLOOR LEVEL

Projection Heaters harness floors, cut fuel costs!

Heaters operate much of the time without using steam! Exclusive temperature equalizing system drives heat trapped by high ceilings down to worker level, prevents stratification!

Warm air trapped in "heat hungry" high ceilings can be driven back down to the floor again by TRANE Projection Heaters . . . automatically.

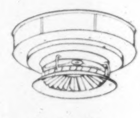
With the exclusive TRANE Temperature Equalizing System in operation, ceiling thermostats permit the heater fans to salvage warm ceiling air, push it down to floor level. Floor thermostats turn on the steam only when the "free" heat near the ceiling has been used. Heaters operate part of the time *without using steam!* Stratification is eliminated, fuel costs are cut substantially.

Besides salvaging ceiling heat, you can put heat *exactly where you need it* with TRANE Projection Heaters.

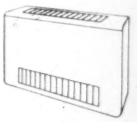
Exclusive patented TRANE Louver Cone Diffusers permit you to divide the air stream . . . spread it . . . or concentrate it into a narrow column for *up to 60% greater throw* so that the heaters can be mounted high above overhead craneways and other obstructions.

If high ceiling heat waste is *your* problem, contact your nearest TRANE Sales Office for additional information. Ask for free bulletin DS-327B or write TRANE, La Crosse, Wisconsin.

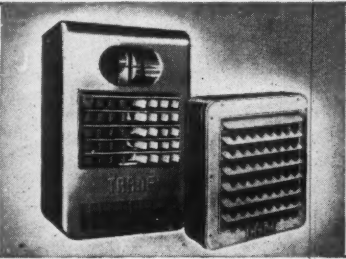
There's a Trane unit heater for every heating need



Projection Heater

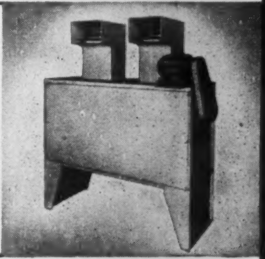


Force-Flo Heater



Trane Torridor blower-type unit delivers large volumes of heated air long distances, with or without ducts. →

← **Trane Horizontal Heaters** put heat *where* you want it, *when* you want it. Both conventional Model H and new Gas-Fired Unit Heater have patented TRANE Louver Fin Diffuser.

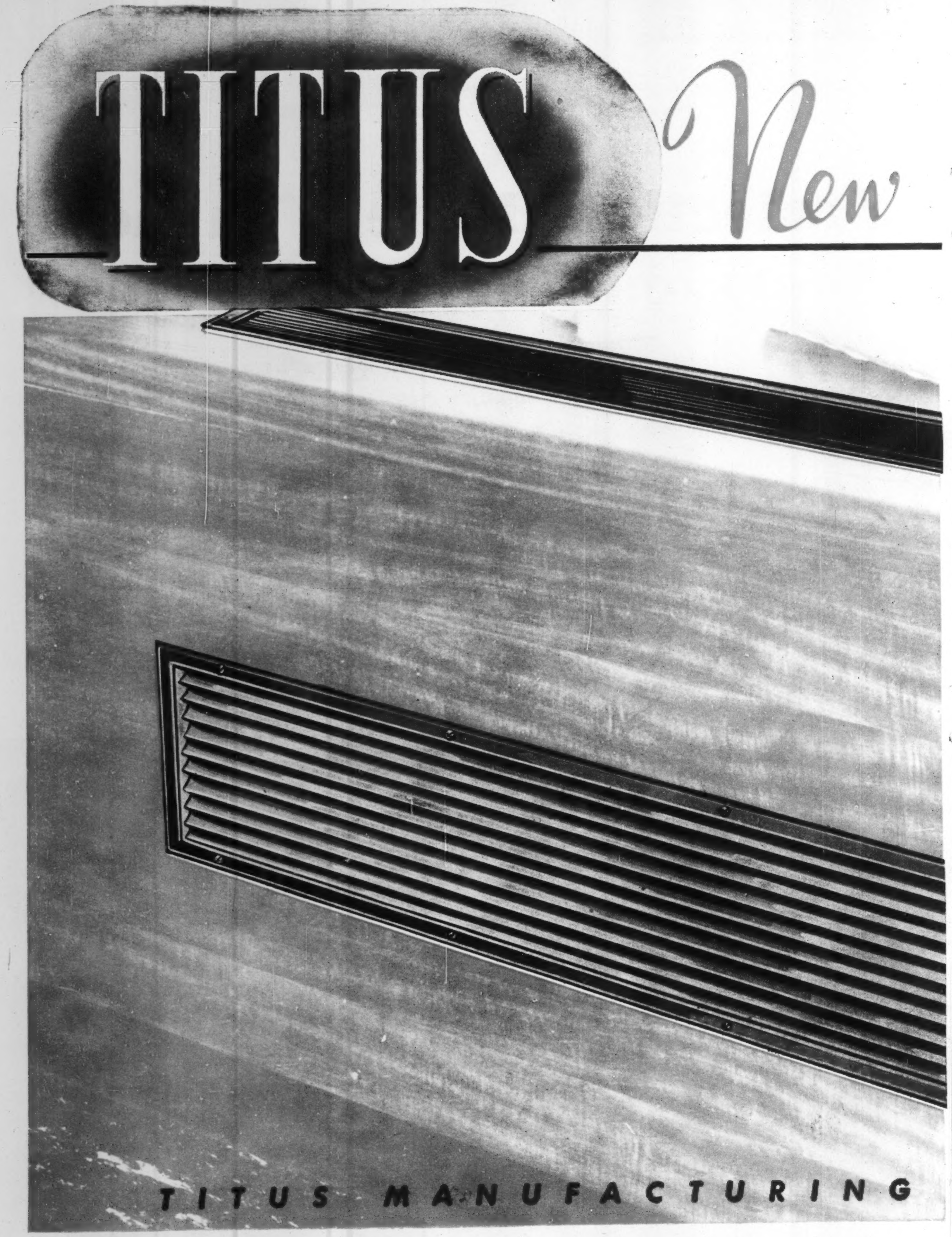


one source • one responsibility

Install TRANE Unit Heaters

to put heat where you want it at low cost

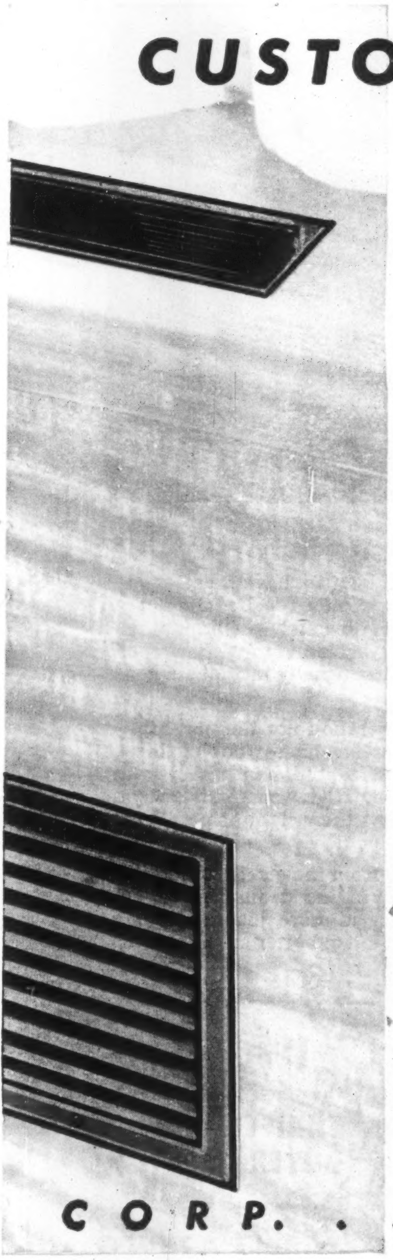
MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT
The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto • 50 U.S. and 15 Canadian Offices


TITUS
New
TITUS MANUFACTURING

Convector Grille*

CUSTOM DESIGN FREEDOM

Without Additional Building Cost



Made with a "decorator's touch" . . . *to add beauty to any installation.* Built above and beyond average demand for performance that's above and beyond average. Cost is kept at standard price level.

EXTRA RUGGED • WILL WITHSTAND HEAVIEST USE AND ABUSE • TAMPER PROOF • NO "SEE THRU" • HEAVY DUTY SUPPORT BARS ON 6" CENTERS • MADE TO ANY SIZE • OVER 70% FREE AREA • INSTALL IN MARBLE, TILE OR ANY SPECIAL SURFACE • EXTRA WIDE BLADES . . . HEMMED FOR ADDED STRENGTH • AVAILABLE WITH DAMPER FOR VOLUME CONTROL OR SHUTOFF

Free Catalog

TITUS Airfoil Grilles offer features which dollar for dollar cannot be duplicated. Get the complete facts on these famous units. Write today.

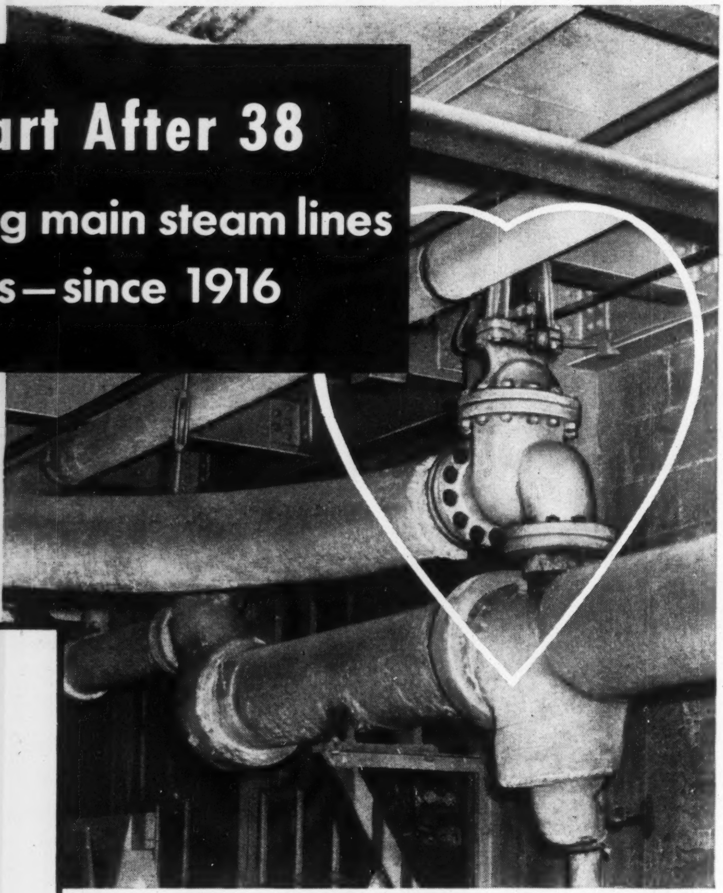
FACTS ON
CONSTRUCTION
PERFORMANCE
SELECTION
SPECIFICATION
Air-foil

** Available also in famous Titus Extruded Aluminum models. Refer April, 1954 Issue Architectural Record.*

CORP. . . . WATERLOO, IOWA

Young at Heart After 38

Crane valves policing main steam lines with no repairs—since 1916



The Installation

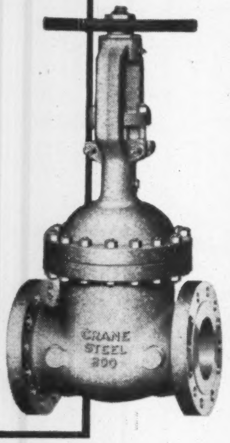
In the Lehigh Portland Cement Co. plant at Oglesby, Ill. Original installation of 6- and 3-inch Crane steel valves in boiler-to-turbine steam piping. Working pressure: 160 pounds at about 475 deg. F.

Valve Service Ratings

SUITABILITY:
Hard to Beat
MAINTENANCE COST:
Not a penny for repairs
SERVICE LIFE:
38 yr.—still O. K.
OPERATING RESULTS:
Lowest cost steam control
AVAILABILITY:
Complete Crane line
of modern patterns

The Valve

Like their 1916 counterpart designs, modern Crane Steel Valves give you performance that wins preference in every industry. They give you the values of steady leadership in steel casting . . . quality design . . . precise manufacturing. And the range of the Crane line in pressure classes, materials, and patterns, meets every need. See your No. 53 catalog, or your Crane Representative.



The Case History

Never, since installed in 1916, have these Crane valves been out of service for repairs. Only care given—and good care, obviously—is prompt repacking of the stuffing box and lubrication when needed. Such attention usually includes a general clean-up.

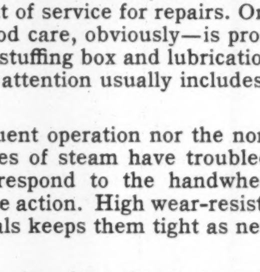
Neither infrequent operation nor the non-lubricating properties of steam have troubled these valves. They respond to the handwheel with smooth, positive action. High wear-resistance in seating materials keeps them tight as new, year after year.

Buying quality valves from the start assured this amazingly low-cost main line steam control. Today this buying policy is more justifiable than ever. And today as in 1916, better quality valves mean Crane valves.

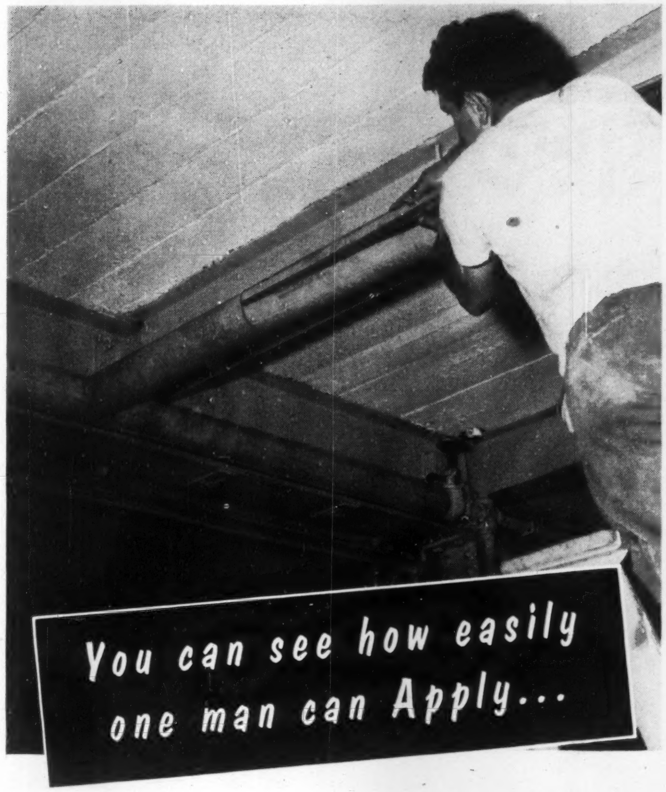
THE BETTER QUALITY... BIGGER VALUE LINE... IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas



VALVES • FITTINGS • PIPE • PLUMBING • HEATING


You can see how easily one man can Apply...

BALDWIN-HILL

MONO-KOVER

ONE PIECE PIPE INSULATION

Its light weight and "snap-on" feature contributes to ease of handling that cuts time and cost on every job. This means bids can be won, and contracts completed well within the allotted time. And MONO-KOVER is outstanding in its resistance to damage or breakage during application.

B-H MONO-KOVER AVAILABLE WITH VAPOR-BARRIER JACKET

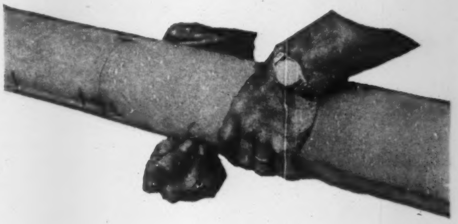
Send for MONO-KOVER illustrated bulletin with complete data on how to apply, properties, efficiency, selection help, size and thickness tables.

BALDWIN-HILL COMPANY

1709 BREUNIG AVE. • TRENTON 2, NEW JERSEY
Kalamazoo, Mich...Huntington, Ind...Temple, Tex.

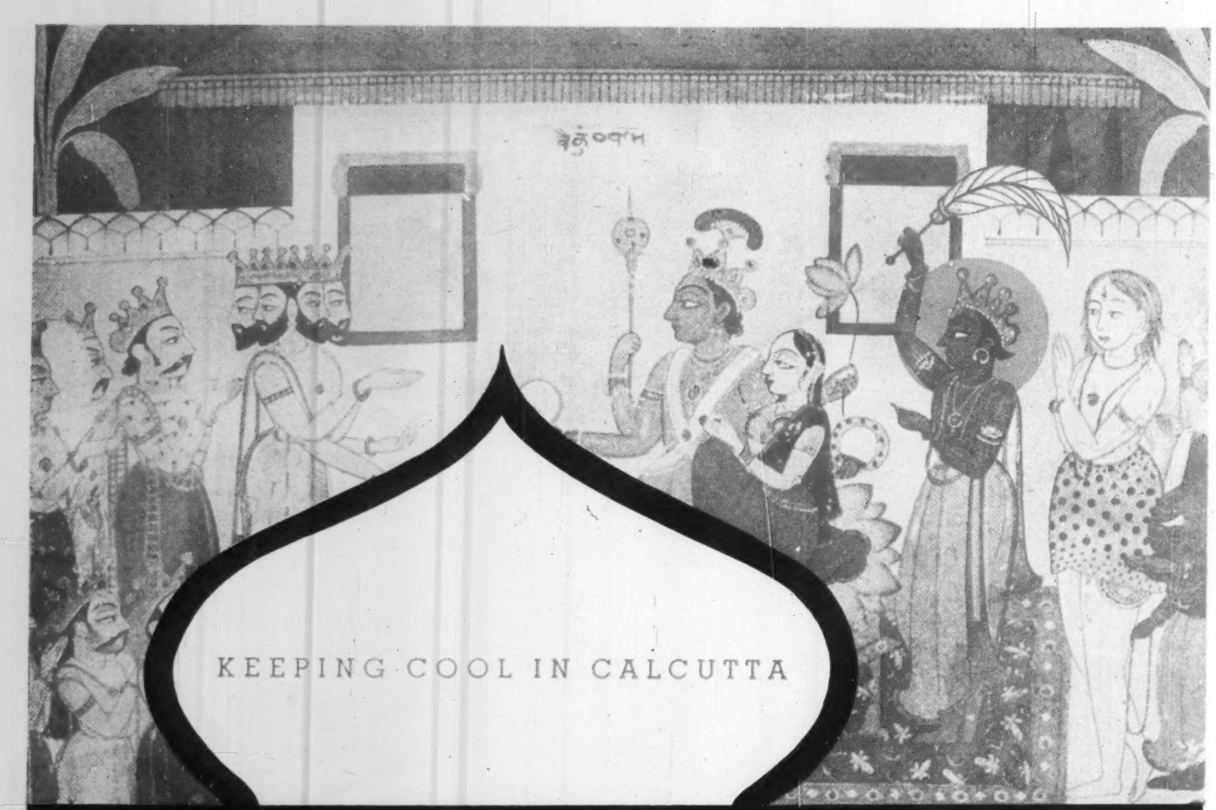
It's a SNAP to Apply

Simply spread each one-piece section at the seam and slip one end over the pipe. Run hands along the MONO-KOVER and it snaps into place to fit snugly around the pipe. Application takes a minimum of effort, saving time and up to 50% in cost.



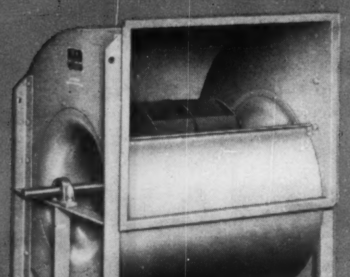
Press the seam together and apply any standard type of fastening — tape, staples, metal bands, muslin, paste or others. The natural resilience of MONO-KOVER holds it on the pipe so that both hands are free for fastening.

B-H MONO-KOVER can be painted as desired for appearance and to conform with surroundings.



KEEPING COOL IN CALCUTTA

Keeping the famous Society Theatre in steaming Calcutta comfortably cool is a man-sized role. Utility Blowers were chosen for that role. Relaxed audiences applaud the choice, while Utility Blowers answer encore after encore throughout the world.

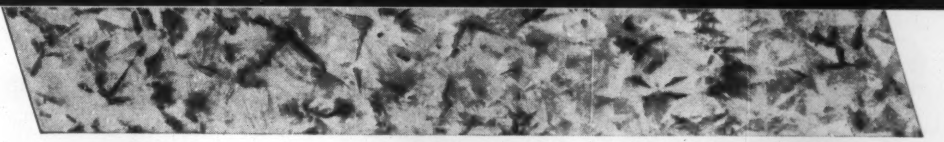


UTILITY

Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Producers of blowers and blower parts for original equipment manufacturers. Write for catalogue data.

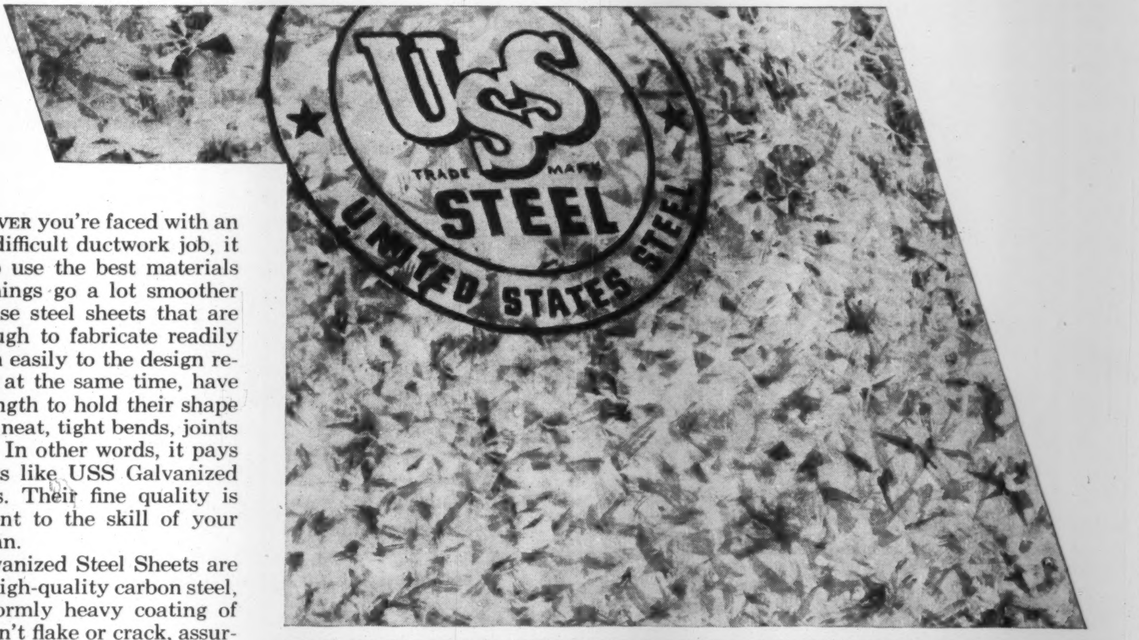
UTILITY FAN CORP.
911 East 59th Street
Los Angeles 1, California

A DIVISION OF UTILITY APPLIANCE CORP.
MEMBER OF NATIONAL ASSOC. OF FAN MFRS.
NAFM



USS Galvanized Steel Sheets

back up good workmanship on complicated installations

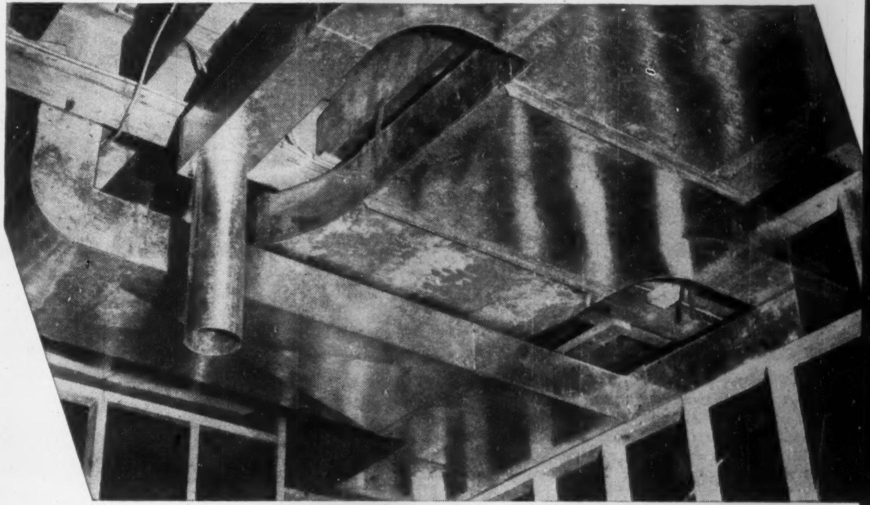


Whenever you're faced with an unusual or difficult ductwork job, it pays you to use the best materials possible. Things go a lot smoother when you use steel sheets that are flexible enough to fabricate readily and conform easily to the design required—and at the same time, have enough strength to hold their shape and to form neat, tight bends, joints and angles. In other words, it pays to use sheets like USS Galvanized Steel Sheets. Their fine quality is a complement to the skill of your best workman.

USS Galvanized Steel Sheets are made from high-quality carbon steel, with a uniformly heavy coating of zinc that won't flake or crack, assuring a lasting protection from rust and corrosion. Because all USS Steel Sheets are uniform in flatness, ductility and workability, they can be bent, cut or stamped easily and quickly.

Your customers know and appreciate the quality that stands behind the USS Label appearing on USS Galvanized Steel Sheets. It will pay you—in satisfied customers and repeat orders—to cash in on the wide acceptance of this well-known product.

USS Galvanized Steel Sheets are available in quantity now. You can be sure that you can get all you need to handle any size job. Ask your sheet distributor or our nearest office. United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.



UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS GALVANIZED STEEL SHEETS

4-1689

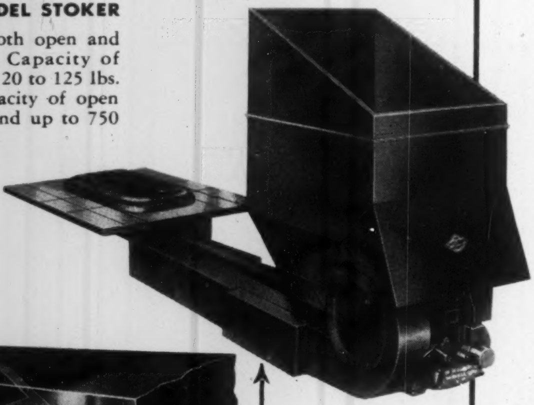
UNITED STATES STEEL

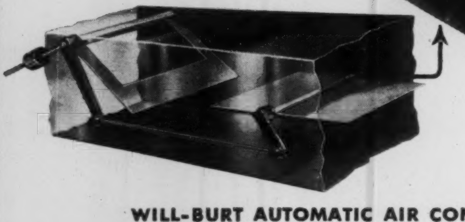
SAFE, CLEAN COAL HEAT...

ENGINEERED FOR LOW COST INSTALLATION... TROUBLE-FREE OPERATION & MAINTENANCE—*OBTAIN ALL THESE ADVANTAGES WITH A* WILL-BURT STOKER

WILL-BURT HOPPER MODEL STOKER

available in both open and closed models. Capacity of closed models: 20 to 125 lbs. per hour. Capacity of open models: 150, and up to 750 lbs. per hour.





WILL-BURT AUTOMATIC AIR CONTROL

assures the proper combustion of fuel during the operating period as well as during the time the blower and feed screw are off. This patented device prevents a condition of smoke and soot. It allows for dissipation of any intense heat that may be surrounding the tuyeres or dead plate by permitting induction of normal draft to the fire bed. It automatically assures the most efficient combustion of bituminous coal in ever-changing fuel bed conditions.

WILL-BURT CONTROL PANEL

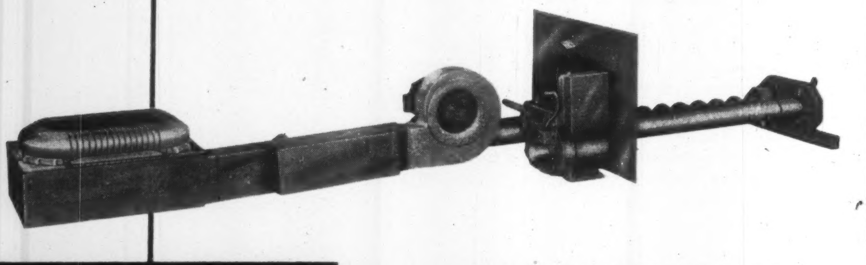
provides the proper combination of disconnect, selector and time switches, holds fire controls and shear pin alarms, wired and factory tested. Combined with operating, limit and low-water controls, and shear pin switches, these controls provide the additional factor of safety preferred in heating systems in schools, hospitals, churches, institutions, etc.

Coal fired with a Will-Burt Stoker is the preferred method of heating wherever low-cost installation, clean coal heat and a factor of greater safety are of utmost importance. Will-Burt Stokers are engineered for application to a variety of coal burning boilers and furnaces, providing trouble-free performance, particularly where installations in schools, hospitals, churches, institutions, apartments and factory buildings require relief from maintenance throughout the heating seasons. The Will-Burt patented automatic air control delivers the correct quantities of air for complete efficient combustion during the operating and off periods—providing low-cost, clean coal heat. Prevention of smoke and soot, such as is usually prevalent when the fire is starved for air, is practically eliminated by air automatically induced to meet ever-changing fuel bed conditions.

Automatic and efficient controlled heating, as well as a factor of greater safety, is assured with Will-Burt Stoker safety devices and control panel—available in a standard unit ready to install and operate. Safety shear pin and disconnect switch are provided on all model stokers and are designed to be reset easily without any special tools. A bell or light signal can be installed to indicate a sheared pin.

"Coal fired with a Will-Burt Stoker" is low-cost heat.

Write for Engineers' Reference Manual which includes general stoker data and suggested specifications for stokers; also installation diagrams for Will-Burt hopper and bin fed stokers and Will-Burt control panels.



WILL-BURT BIN FEED STOKERS

reduce cost of coal handling and maintenance to an all-time low. For application with various types of bituminous coal burning boilers and furnaces.

The **WILL-BURT** *Company*

OVER TWENTY-FIVE YEARS IN THE STOKER BUSINESS

BOX 902 • ORRVILLE, OHIO

Youngstown at Bradley U.

7 Points of uniform goodness in YOUNGSTOWN PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

Bradley University Library, Peoria, Illinois, Gregg & Briggs, architects. General contractors —V. Jobst & Sons, of Peoria.

HAVING PROBLEMS?
For information and service, get in touch with the local distributor of Youngstown Steel Pipe—or phone our nearest District Sales Office.

● This new library at Bradley University is another modern building for which the architects specified Youngstown Pipe.

Made of finest steel, its quality closely controlled by one producer from ore mine right through to the final threading operation, Youngstown Pipe will insure adequate protection to the water supply for years to come.

Youngstown

QUALITY YOUNGSTOWN SERVICE

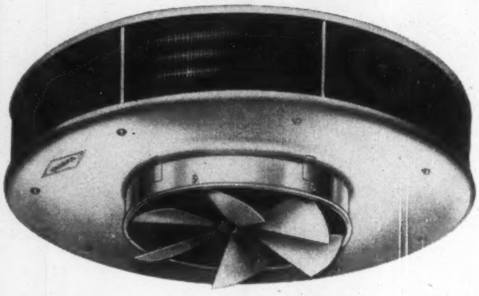
THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices: Youngstown, Ohio - District Sales Offices in Principal Cities

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - BAR SHAPES - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - RAILROAD TRACK SPIKES

UNARCO DOWN BLOW UNIT HEATER

Drop-out motor for easy service. Full venturi for quiet operation. Full range of capacities in standard CFM and high CFM.



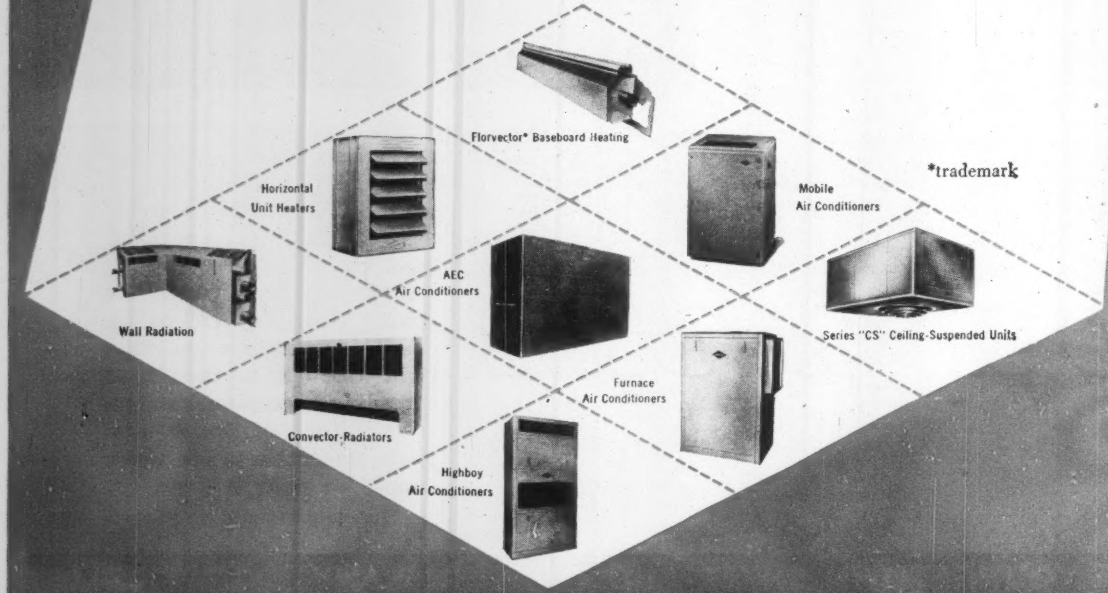
UNARCO®

year 'round weather conditioning*

Whether your needs are heating or air conditioning equipment, get the facts on the complete UNARCO line before you buy. UNARCO offers so much more in quality, economy and efficient performance.

UNARCO heating and cooling products are priced to sell . . . available in a complete range of types and sizes.

55 sales offices from coast to coast and Canada to serve your needs.


Florvector* Baseboard Heating
Horizontal Unit Heaters
Mobile Air Conditioners
Wall Radiation
AEC Air Conditioners
Series "CS" Ceiling-Suspended Units
Convector-Radiators
Furnace Air Conditioners
Highboy Air Conditioners

*trademark

UNION ASBESTOS & RUBBER COMPANY
HEATING AND COOLING DIV. • 332 S. Michigan Ave. • Chicago 4, Ill.

your pump costs start down right here

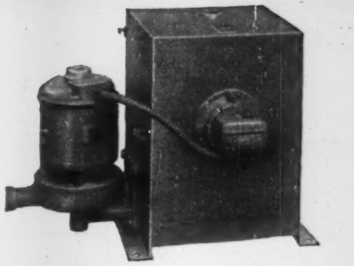
You're looking at Dunham's new mechanical seal . . . just *one of many* reasons why improved Dunham CHV Condensate Pumps cut pumping costs all across the board. For example—

MAINTENANCE COSTS? Lower—since Dunham's new seal completely eliminates stuffing boxes . . . and repacking maintenance. In addition, pumps maintain rated capacities for years without repairs, since there are no close clearance parts to wear out.

OPERATING COSTS? Less, too, because these compact pumps use new low horsepower per EDR.

INSTALLATION COSTS? Way down. No special wiring needed. No bars or bed plates. Low return line connections.

ORIGINAL COSTS? Lower than ever before! For all the facts on this re-designed and expanded Dunham line of condensate pumps, just clip and mail the coupon.



DUNHAM CHV CONDENSATE PUMP

Single and Duplex models for capacities from 2,000 EDR through 20,000 EDR.

Heavy-duty CH Condensate Pumps available. Capacities from 2,000 EDR through 50,000 EDR.

DUNHAM CONDENSATE PUMPS

RADIATION • CONTROLS • UNIT HEATERS • PUMPS • SPECIALTIES

QUALITY FIRST FOR FIFTY-ONE YEARS

C. A. DUNHAM COMPANY • CHICAGO • TORONTO • LONDON

C. A. DUNHAM COMPANY
Dept. HPAC-9, 400 W. Madison St.
Chicago 6, Illinois
Send Condensate Pump literature

Name____

Company______________________________________

Address_______________________________________

City__________________Zone______State__________

When you design or install

Weather Modulated Control Systems...

"ALL-OUT" ENGINEERING SERVICE—Sarcotherm engineering service is in a class by itself. It helps you develop the best control hook-up possible and *carries through* every step of the way.

COMPLETE INSTALLATION DRAWINGS AND WIRING DIAGRAMS—Not just general drawings . . . but complete, tailor-made drawings and diagrams worked up for each individual job.

ON-THE-JOB HELP—Contractors get full cooperation and technical assistance backed by many years of experience.

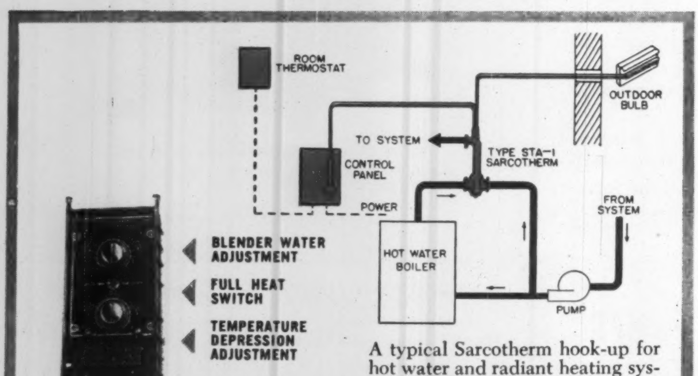
take advantage of this most unusual engineering service!

Sarcotherm offers you an exclusive, all-out engineering service specially designed to save you valuable time in planning and installation.

Its experienced engineering staff is always available. Beginning at the architect's drawing board, Sarcotherm's engineering service extends through the entire job right up to actual operation of the equipment.

Coupled to this service are the basic advantages of Sarcotherm weather modulated controls: simplicity of design; simplicity of installation, operation and maintenance; low initial cost. All these benefits plus unlimited engineering help combine to guarantee you complete user satisfaction and considerable savings in time and operating expense.

Call in a Sarcotherm engineer on your next job. You'll find it profitable. Write for full details.



Adjustments can be made through a convenient manual control panel, or, if required, a fully automatic program panel may be incorporated into the system.

A typical Sarcotherm hook-up for hot water and radiant heating systems. Three-way, proportioning type mixing valve continuously modulates water temperatures as actuated by outdoor-indoor controls.

SARCOTHERM CONTROLS, Inc.

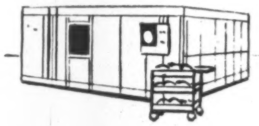
Empire State Bldg., New York 1, N. Y.

An Affiliate of SARCO COMPANY, INC.

Weather Modulated Controls for
HOT WATER, RADIANT AND STEAM
Heating Systems

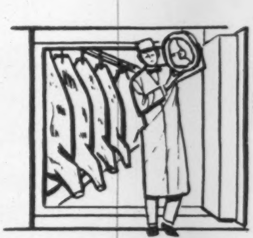
Curtis Refrigeration and Air Conditioning

Gives You More Jobs to Sell...

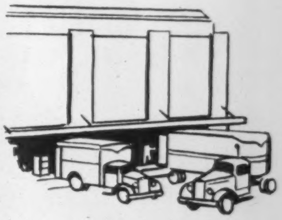


Processing

Locker Installations

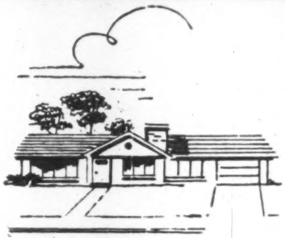


Cold Storage Rooms

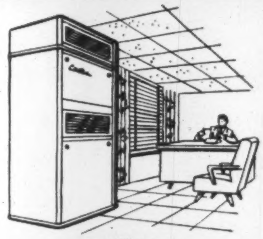


Food Warehouses

ALL KINDS OF REFRIGERATING JOBS

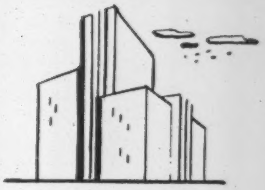


Homes



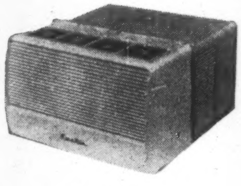
Offices

Businesses

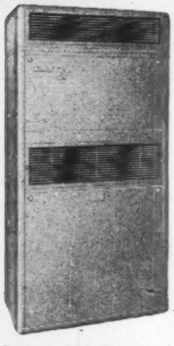


Large Buildings

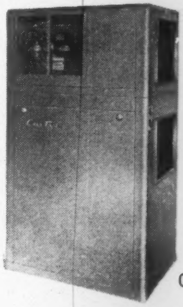
AIR CONDITIONING JOBS—BIG AND SMALL



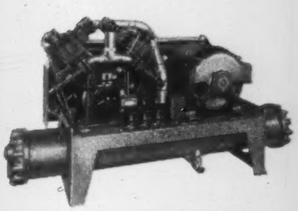
Room Air Conditioners



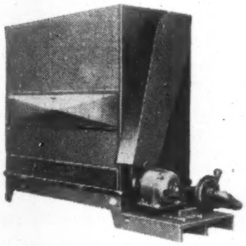
Packaged Air Conditioners
2 to 10 tons



Combination Heating-Cooling Units



Condensing Units up to 80 Tons



Evaporative Condensers,
Cooling Towers,
Matching Air Handling Units

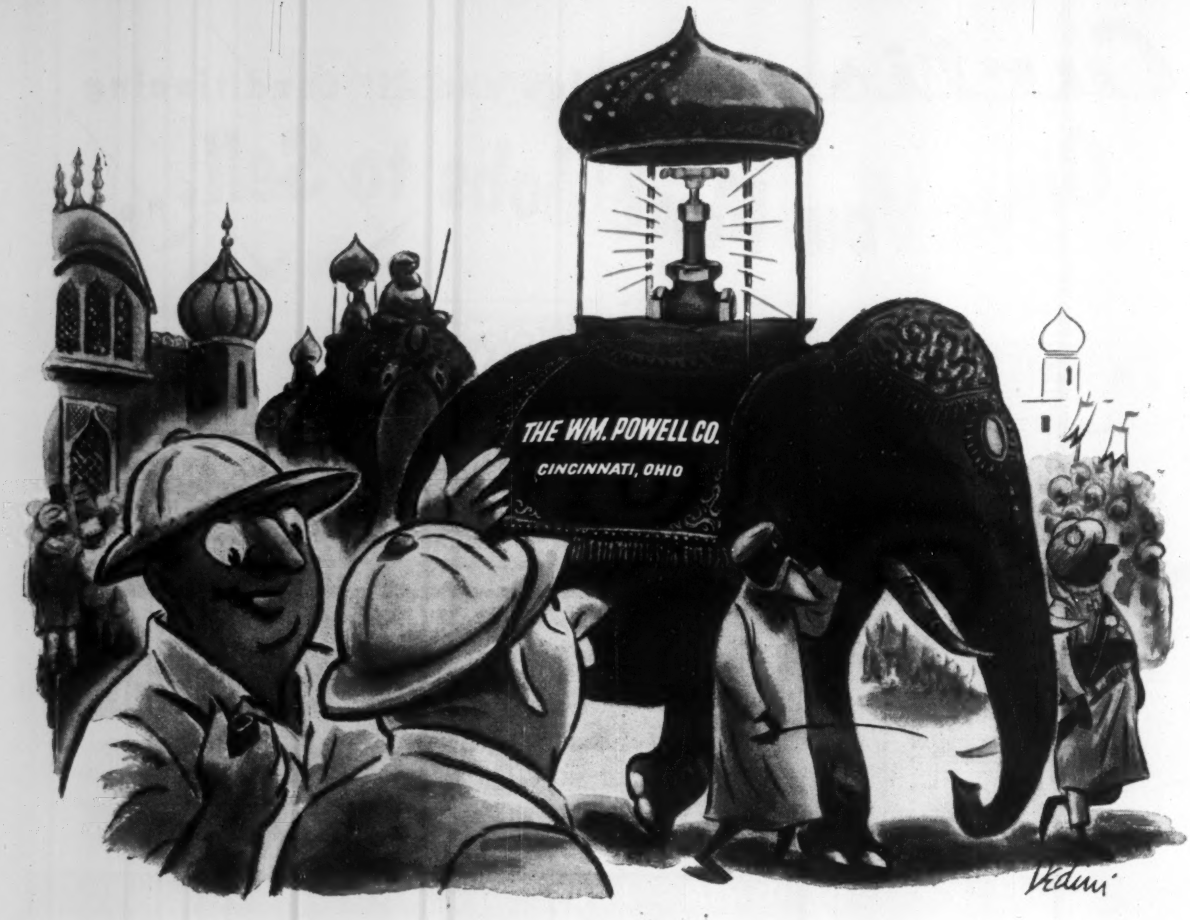
When you handle the Curtis Line, you're ready for practically any profitable job in the field of air conditioning and refrigeration. You're ready to satisfy customers with the industry's top quality equipment line. You're ready to take advantage of Curtis' national advertising in *Saturday Evening Post, Time, Newsweek* and other well-read publications.

It makes profit sense to sell Curtis. To learn if you qualify for a direct factory franchise, write on your company letterhead.

1854 **100** 1954
years
OF SUCCESSFUL MANUFACTURING EXPERIENCE

Curtis REFRIGERATING MACHINE DIVISION
of Curtis Manufacturing Company
1950 Kienlen Avenue, St. Louis 20, Missouri

809



"You see POWELL VALVES everywhere!"

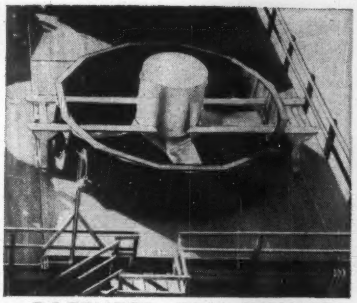
Not surprising when you realize that Powell makes more kinds of valves and has probably solved more valve problems than any other organization in the world. And this has been going on since 1846.

Wherever flow requires dependable control, there's the place for Powell Valves—available through distributors in principal cities. Made ⅛" to 30" and 125 pounds to 2500 pounds W. S. P. Bronze, iron, steel and corrosion resistant alloys. On problems, write direct to The Wm. Powell Company, Cincinnati 22, Ohio.

CONTROLS FOR THE LIFE LINES OF INDUSTRY

Powell Valves *108th year*

We will see you at booth 49 American Institute of Wholesale Plumbing and Heating Supply Association.



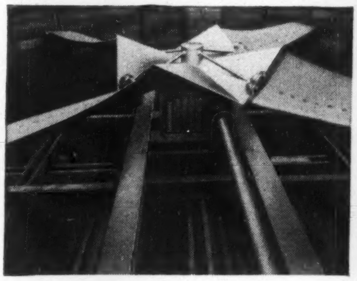
PATENTED FAN DRIVES
Self-ventilated, fully encased, completely integrated assembly.

WHY ?

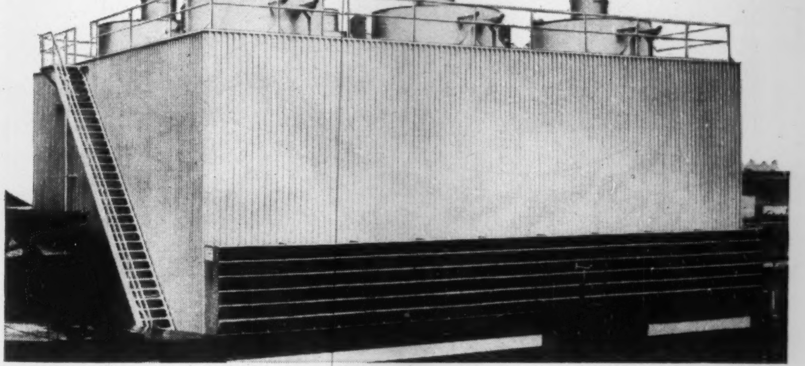
Why do hundreds of critical engineers and contractors choose Pritchard to help them solve their comfort cooling problems?

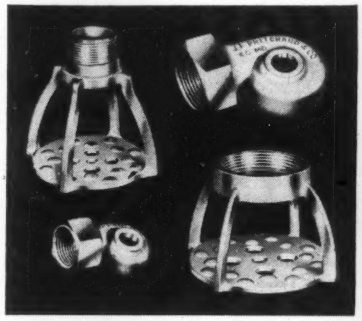
Right now, you probably don't have time to read all the reasons, so we've just pictured several of them for you. But, next time you want the right tower for a specific cooling job, contact Pritchard and find out the rest of the reasons why.

Your Pritchard representative is listed in the classified section of the telephone directory, or you can write direct to the address given below.

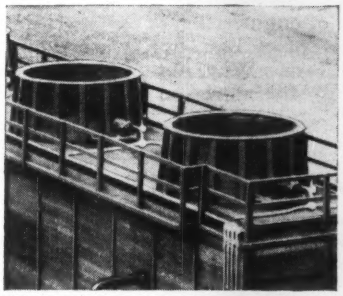


EXCLUSIVE FANS
Designed especially for cooling tower service, low horsepower requirements. Right angle worm gear drive shown here.





MORE EFFICIENT DISTRIBUTORS
Patented low-pressure design for better spray, more efficient cooling.



SUPERIOR FAN THROATS
All redwood unitized design, modified Venturi throat permits close blade tolerances, assures highest efficiency.

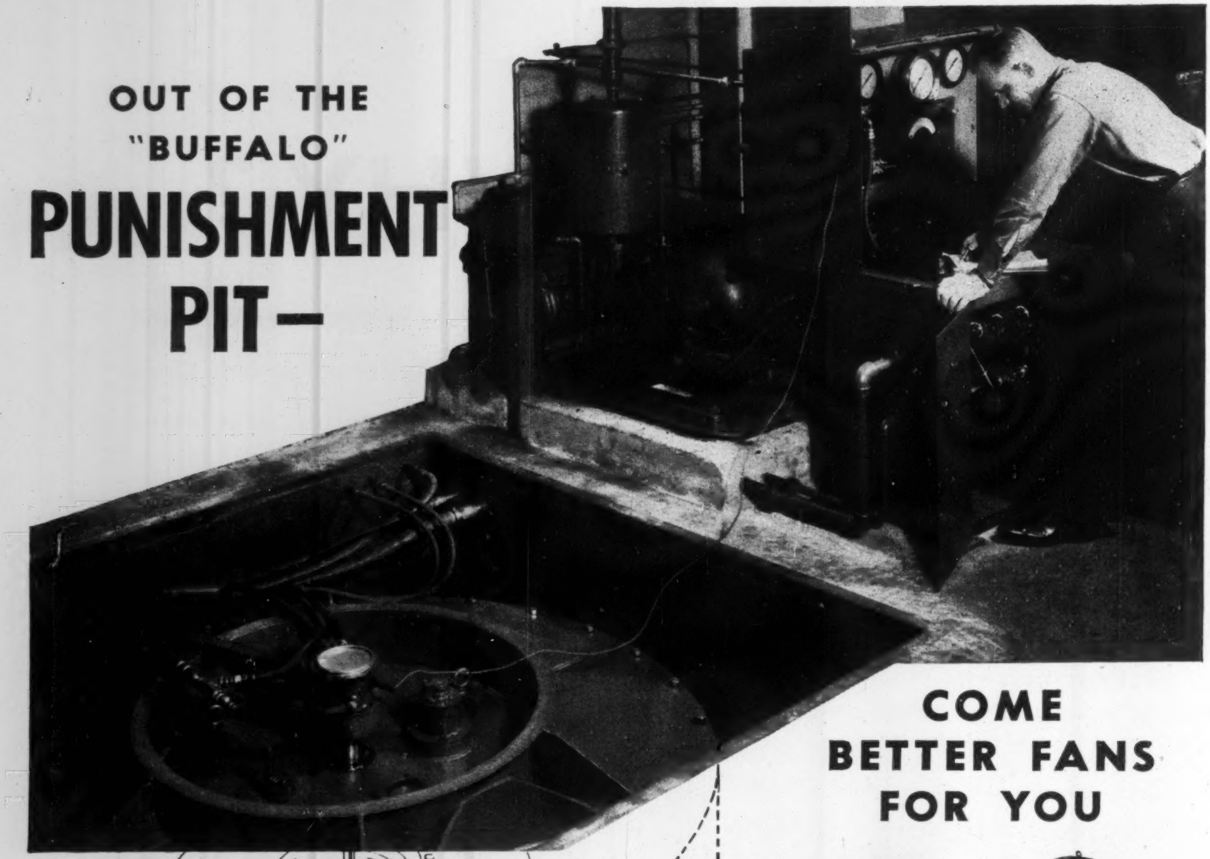
Industry's Partner for Progress

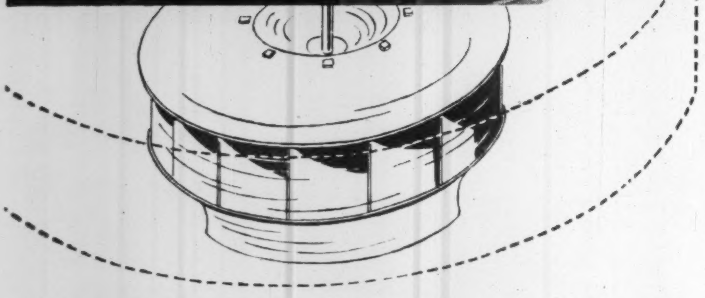
J. F. Pritchard Co.
OF CALIFORNIA
A DIVISION OF J. F. PRITCHARD & CO.
Dept. 410, 210 West 10th St., Kansas City 5, Mo.

COOLING TOWERS
SPECIALIZED HEAT EXCHANGERS
GAS & AIR TREATING EQUIPMENT

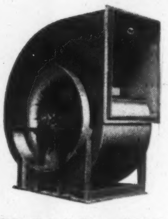
Representatives in Principal Cities from Coast to Coast

OUT OF THE "BUFFALO" PUNISHMENT PIT—

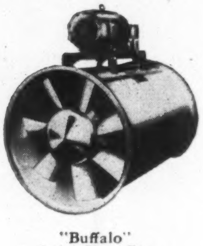




COME BETTER FANS FOR YOU



"Buffalo" Type "BL"
Limit-Load Ventilating Fan



"Buffalo"
Axial Flow Fan

- To be sure that "Buffalo" rotors can stand far greater stress than they would ever encounter in an installation, we deliberately try to destroy them in this "Buffalo" vacuum test pit! Here, in a partial vacuum, the rotor to be tested can be revolved at tip speeds as high as 60,000 and even 70,000 feet per minute. The slightest unbalance, the slightest structural weakness, would result in destruction of the rotor at these fantastic speeds — and it shows up here in the Punishment Pit, not in the installed fan.

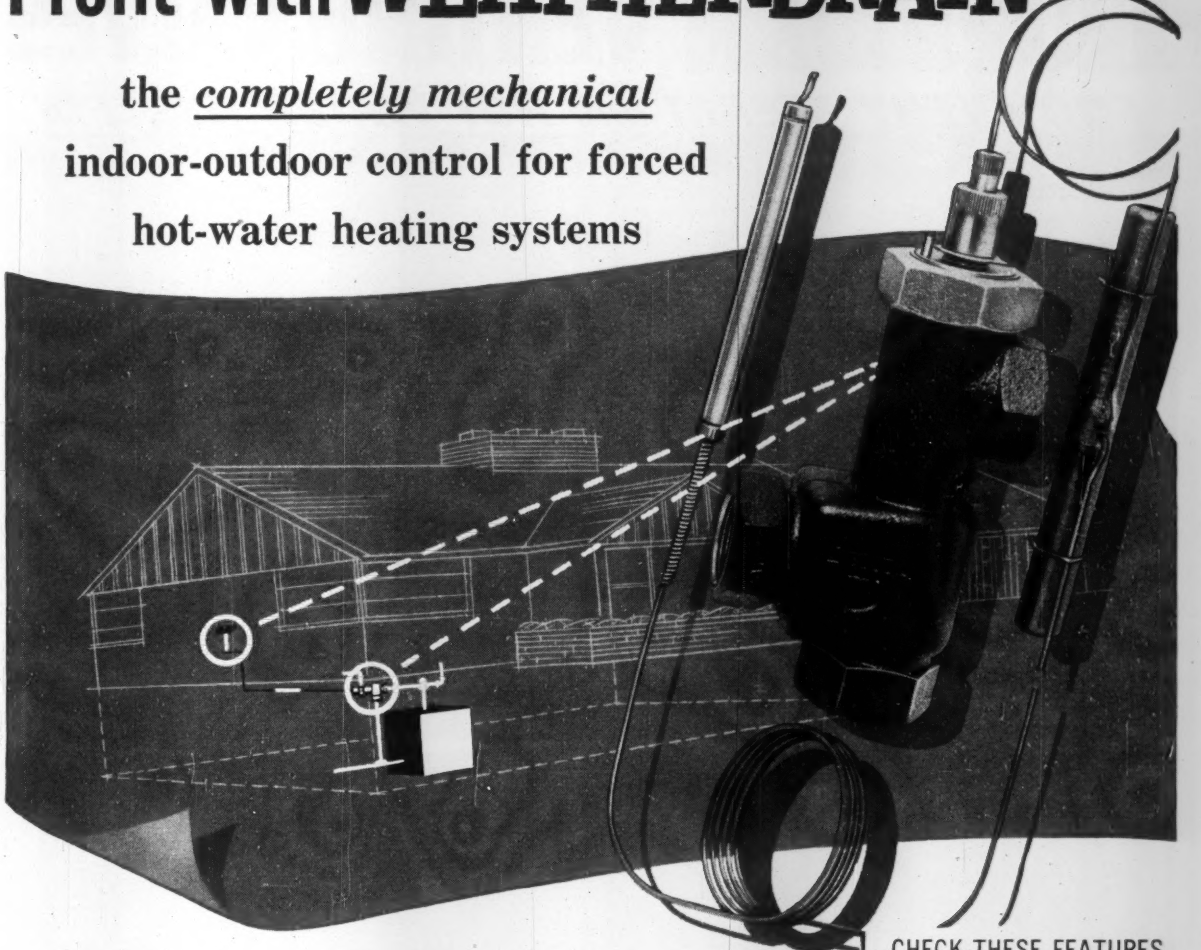
This is just one phase of the rigid testing and excellence of engineering, or "Q" Factor*, which assure you of a best buy when you specify "Buffalo" Fans. Why not write for "Buffalo" engineering literature on *your* air handling problem?

**The "Q" Factor — The built-in Quality which provides trouble-free satisfaction and long life.*

"Buffalo"

BUFFALO FORGE COMPANY
171 MORTIMER STREET BUFFALO, NEW YORK
Publishers of "Fan Engineering" Handbook
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

VENTILATING PRESSURE BLOWING AIR CLEANING COOLING AIR TEMPERING HEATING INDUCED DRAFT FORCED DRAFT EXHAUSTING



Profit with WEATHERBRAIN

the *completely mechanical* indoor-outdoor control for forced hot-water heating systems

CHECK THESE FEATURES

- Varies the water temperature delivered to panels or radiation in exact accordance with the demands of the weather.
- Good for zone systems due to simplicity and reasonable cost.
- Gradual changes in water temperature in the system minimize the undesirable effects of thermal expansion and contraction.
- Very valuable where more than one type of radiation is used or domestic hot water is heated by the boiler, in which cases the electrical boiler resetting type control can not be used.

Completely automatic • Inexpensive
No electronic tubes, relays or delicate mechanisms
Easily installed • Assures constant comfort

Now you can cash in on big, new profits in the hot water heating field with Detroit's amazing new Weatherbrain Control. That's because Weatherbrain indoor-outdoor control offers heating comfort never before possible in forced hot-water heating systems—constantly uniform and completely automatic with no manual adjustment required. The Weatherbrain Control's outdoor bulb senses changes in outside temperature and responds instantly by supplying the exact amount of heat to keep room temperature right where it should be! And because it is entirely mechanical in operation with no expensive, complicated electronic circuits, Weatherbrain Control costs less and is easily installed. See your Detroit Controls wholesaler today or write us direct at the factory for bulletin No. 254.

DETROIT CONTROLS *Corporation*
5900 TRUMBULL • DETROIT 8, MICHIGAN
Division of AMERICAN RADIATOR & STANDARD SANITARY Corporation
Representatives in Principal Cities • Canadian Representatives in Montreal, Toronto, Winnipeg—Railway and Engineering Specialties, Ltd.

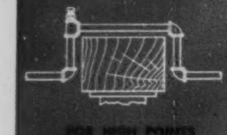
AUTOMATIC CONTROLS for REFRIGERATION
AIR CONDITIONING • DOMESTIC HEATING • AVIATION • TRANSPORTATION • HOME APPLIANCES • INDUSTRIAL USES
Serving home and industry
AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

HOFFMAN VENTING VALVES

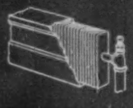
FOR EVERY STEAM and HOT WATER SYSTEM

No. 500

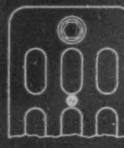
UNIVERSAL AIR VENT



FOR HIGH POINTS



FOR BASEBOARD RADIATION



FOR STEAM RADIATORS

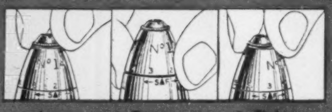
One Hoffman Valve now vents all systems—*automatically!* Adjustable for Manual, Steam or Hot Water venting. Hygroscopic fibre discs *automatically* open to allow air to vent, *automatically* close against steam or water. Operates at maximum steam pressure of 15 lbs. and maximum water pressure of 50 lbs. Size connection: ⅛".

No. 1A BALANCER

WITH CHOICE OF 6 VENT PORTS TO FIT EVERY VENTING REQUIREMENT

An Adjustable Port air valve. This feature is of extreme importance in obtaining true proportional venting for different size radiators and for radiators located at different distances from the boiler. Each valve individually adjusted and tested at the factory for venting capacity. Size connection: ⅛".

PORTS EASILY ADJUSTED FOR PROPORTIONAL VENTING

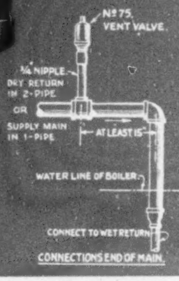


1. Loosen knurled nut
2. Turn cap to desired port
3. Tighten knurled nut

No. 75

MAIN VENT

For relieving air from mains. Float seals the port when water is encountered. Recommended for installations where large venting capacity within pressure limits is required. Size connection: ¾" male, ½" female.


Nº 75 VENT VALVE.
¾ NIPPLE.
DRY RETURN IN 2-PIPE
OR
SUPPLY MAIN IN 1-PIPE
AT LEAST 15"
WATER LINE OF BOILER.
CONNECT TO WET RETURN

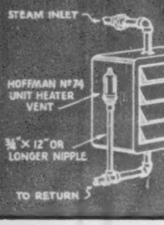
CONNECTIONS END OF MAIN.

No. 74

FOR UNIT HEATERS

This valve has a working pressure up to 35 pounds. The valve vents air when present, with rising, dropping or steady pressure. Effectively eliminates air from the Unit Heater to keep it "piping hot" at all times. Capacity: 300 C.I.M. at 1 pound pressure and 800 C.I.M. at 10 pounds and over. Sturdy construction — drawn brass body, nickel trim.

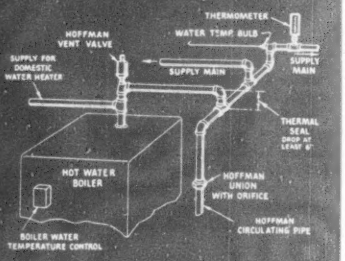
Size conn: ¾" male, ½" female.


STEAM INLET
HOFFMAN Nº 74 UNIT HEATER VENT
¾" × 12" OR LONGER NIPPLE
TO RETURN

No. 79

HOT WATER VENT

A typically fine quality Hoffman Vent Valve developed for positively removing air from the piping of any hot water system. This Valve will give continuous venting under all conditions. Tapped at top for ¼" pipe connection to conduct away moist air, where needed. Size conn: ¾" male, ½" female. Max. operating press. 75 lbs.


THERMOMETER
WATER TEMP. BULB
HOFFMAN VENT VALVE
SUPPLY FOR DOMESTIC WATER HEATER
SUPPLY MAIN
SUPPLY MAIN
THERMAL SEAL DROP AT LEAST 6"
HOT WATER BOILER
HOFFMAN UNION WITH ORIFICE
HOFFMAN CIRCULATING PIPE
BOILER WATER TEMPERATURE CONTROL

STOP
CHECK YOUR STOCK

Have these valves in your stock for the early replacement jobs

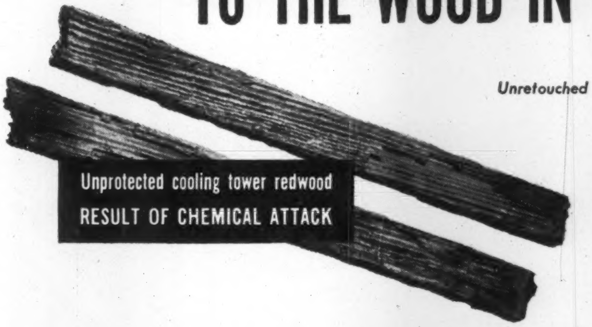
For either one-pipe or two-pipe steam, hot water, residential or industrial heating—Hoffman assures you the correct Vent Valve for each specific requirement. For the hard-to-balance radiators, the Hoffman line includes adjustable-port valves, available for vacuum and non-vacuum systems. It is not too early to order adequate stocks of Main and Radiator Vent Valves for modernizing jobs. Call your Wholesaler.

HOFFMAN SPECIALTY MFG. CORP. • 1001 York Street, Indianapolis 7, Indiana

Makers of Valves, Traps, Hot Water Heating Systems, Vacuum and Condensation Pumps . . . Sold by Leading Wholesalers of Heating and Plumbing Equipment

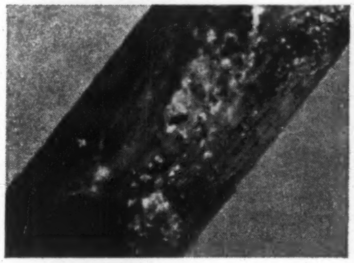
LOOK WHAT CAN HAPPEN TO THE WOOD IN COOLING TOWERS

Unretouched photographs


Unprotected cooling tower redwood
RESULT OF CHEMICAL ATTACK

Unprotected cooling tower redwood
RESULT OF FUNGUS ATTACK

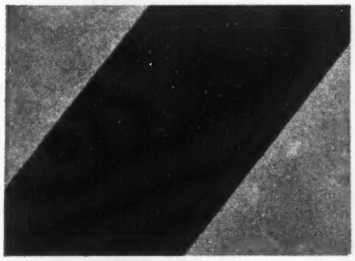
PRESSURE CREOSOTING ADDS YEARS OF LIFE TO HALSTEAD & MITCHELL COOLING TOWERS



FUNGUS ROTTED UNPROTECTED DECKING

Unretouched photographs

CLEAN PRESSURE-CREOSOTED DECKING



Examine these unretouched photographs carefully. Constantly wetted wood decking in a cooling tower is subject to immediate attack by fungus and marine parasites. It is also subject to chemical deterioration from acids in water. All wood used in Halstead & Mitchell Cooling Towers is protected against these twin enemies.

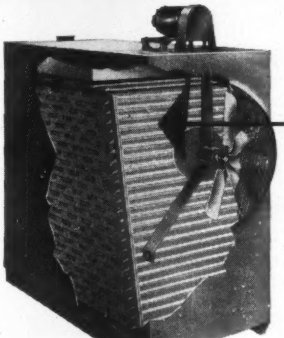
WHY PRESSURE CREOSOTING?

Creosote . . . *with 162 elements toxic to fungus growth and parasites* . . . also makes wood more resistant to chemical attack. Deep penetration of the wood by Koppers Pressure-Creosoting gives the longest possible wetted decking life. Therefore, all Halstead & Mitchell Cooling Tower decks are Pressure-Creosoted, and are guaranteed against rotting due to fungus growth . . . for 20 years!

ONLY HALSTEAD & MITCHELL OFFERS THE

20-Year Guarantee!

ON THE WETTED DECK SURFACE against rotting by fungus attack



2 thru 100 Tons

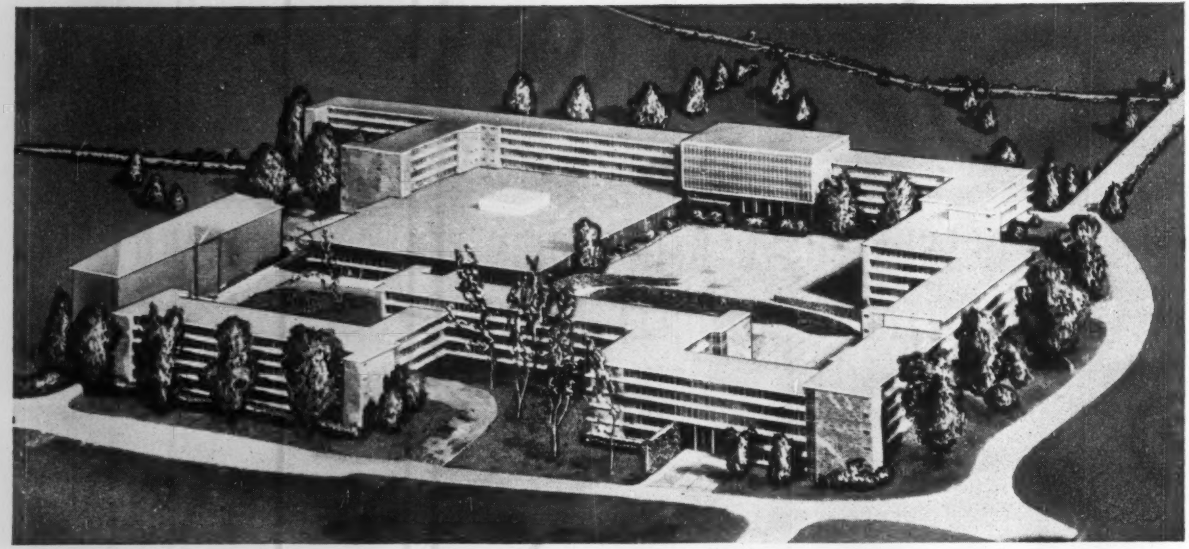
Sheet-Steel Cabinets,
5-times protected
Stainless Steel Fans and Shafts
Weather Shielding
Everdur Bolts for ease of
disassembly at any time.

At Leading Refrigeration & Heating Wholesalers Everywhere

HM
Halstead & Mitchell

OFFICES: Bessemer Bldg., Pittsburgh 22, Pa.

Oh, I see



Architects for these $5,000,000 Dormitories are Wm. G. Lyles, Bissett, Carlisle & Wolff of Columbia, South Carolina.

. . . they're using our valves at Clemson College Dormitories

Scheduled for occupancy this fall, Clemson College Dormitories, Clemson, South Carolina, will contain 1,000 rooms. This structure, built in the form of a quadrangle, represents the latest in architectural design and construction.

OIC Valves were selected for much of the piping here by Daniel Construction Company, Inc., through OIC's distributor, Construction Supplies, Inc., both of Greenville, South Carolina—evidence of the confidence which builders everywhere have in OIC Valves.

The OIC Long Line of Valves takes care of every valving requirement in structures of this kind. For a free copy of OIC's Catalog Digest, write:

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC
FOUNDED 1881

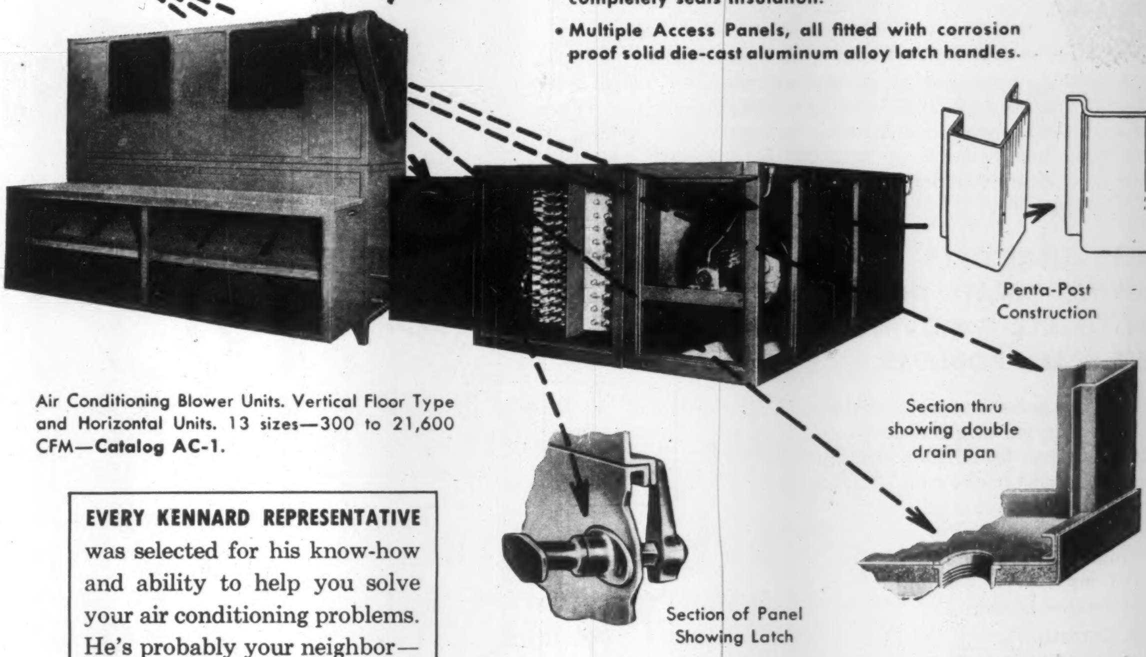
VALVES | **BRONZE & IRON, FORGED & CAST STEEL, LUBRICATED PLUG VALVES**

KENNARD *Engineered* AIR CONDITIONING BLOWER UNITS

give you full value

Plus

- Penta Post Frames (gives strength to spare). Test as shown by Independent Testing Laboratory.
- Drain Pans—double metal pan under coil section completely seals Insulation.
- Multiple Access Panels, all fitted with corrosion proof solid die-cast aluminum alloy latch handles.

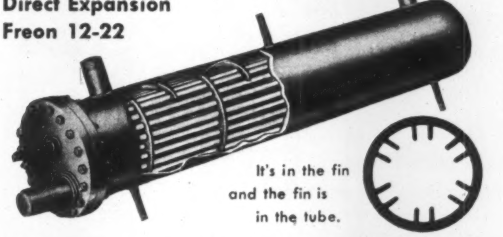

Penta-Post Construction
Section thru showing double drain pan
Section of Panel Showing Latch

Air Conditioning Blower Units. Vertical Floor Type and Horizontal Units. 13 sizes—300 to 21,600 CFM—**Catalog AC-1.**

EVERY KENNARD REPRESENTATIVE was selected for his know-how and ability to help you solve your air conditioning problems. He's probably your neighbor—Phone him today.

KENNARD SHELL AND TUBE LIQUID CHILLERS

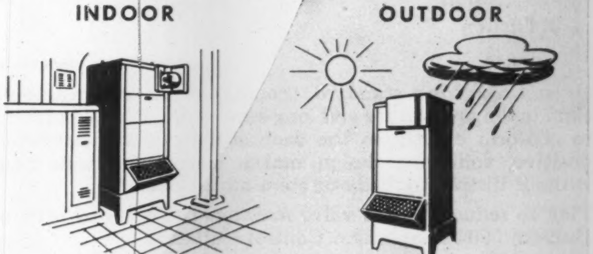
Direct Expansion
Freon 12-22


It's in the fin and the fin is in the tube.

Revolutionary internally finned tubing makes them better than 50% lighter and smaller—positive oil return—no Freon head gasket (exclusive with KENNARD) — smaller Freon charge. Sizes 2 to 200 tons. **Catalog LC-1.**

KENNARD KT WATER SAVERS

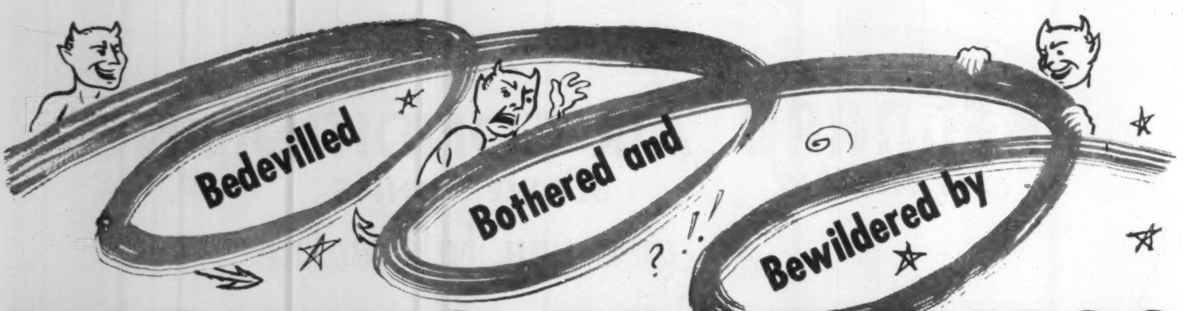
(Induced Draft Cooling Towers)


INDOOR
OUTDOOR

Centrifugal type fan, redwood wetted deck. 5 popular sizes 3, 5, 8, 11 and 16 Tons.

Catalog KT-2.

KENNARD CORPORATION • 1817 S. HANLEY ROAD
ST. LOUIS 17, MO., U.S.A.



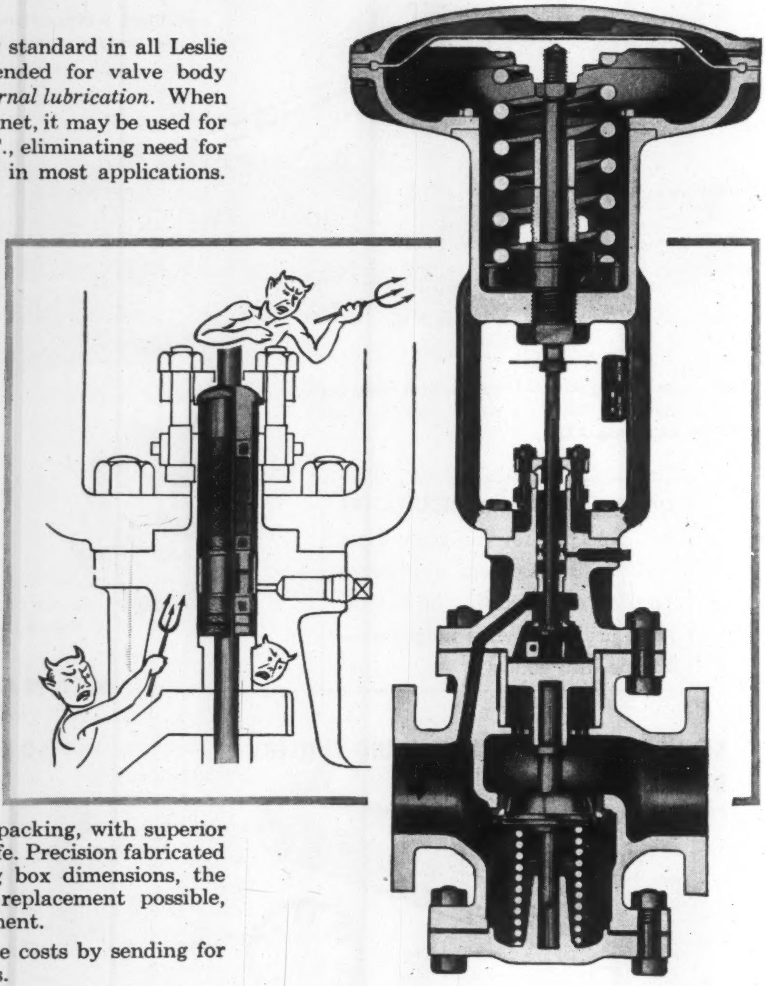
PACKING PROBLEMS?

The new Leslie Lubrisoft® Packing now standard in all Leslie Diaphragm Control Valves is recommended for valve body temperatures up to 500° F. *without external lubrication.* When used with the Leslie thermo-isolating bonnet, it may be used for valve body temperatures up to 1050° F., eliminating need for external lubricators and isolating valves in most applications.

LESLIE LUBRISOFT® PACKING "BEATS THE DEVIL" OUT OF ALL 8 MOVING STEM SEAL PROBLEMS

Each of the several types of Lubrisoft split ring packing is specifically designed to maintain the low-friction stem seal against one or more of these deteriorative service conditions:

1. **Internal pressure, temperature and fluid**
2. **Contamination**
3. **Corrosion**
4. **Electrolytic Action**
5. **Oxidation**
6. **Extrusion**
7. **Abrasion**
8. **Friction**



Overall result is a standard, economical packing, with superior stem sealing properties and long service life. Precision fabricated to conform exactly to the deep stuffing box dimensions, the positive, split ring design makes fast replacement possible, without disturbing body or stem adjustment.

Plan to reduce control valve maintenance costs by sending for Bulletin 5304 Diaphragm Control Valves.

LESLIE CO., 237 GRANT AVENUE • LYNDHURST, NEW JERSEY

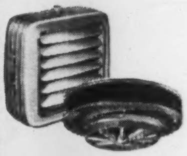
LESLIE TRADE LESLIE MARK **VALVES**

2918A

"STILL FAR AHEAD IN QUALITY AND PERFORMANCE"

YOU name the heating job . . .

STEAM

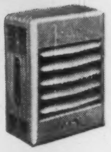


Modine builds 13 sizes of vertical delivery units with choice of 5 easily attached optional deflectors. Horizontals in 19 standard and low - outlet temperature models.

HOT WATER

Your choice of 13 vertical delivery units with 5 easily attached deflectors. Five sizes of horizontal models, designed specifically for hot water.

GAS



Only Modine gas-fired units have stainless steel burners and a choice of stainless or aluminized steel heat exchangers. Seven sizes — 25,000 to 220,000 Btu.

Modine offers the unit heater to do it better . . . at lower cost

Compare Modine steam and hot water units with all other makes

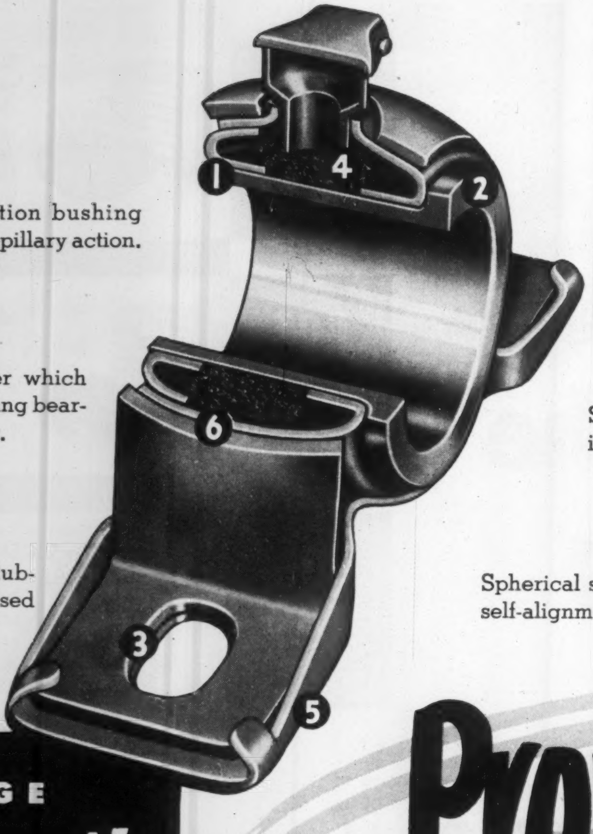
For over 25 years, Modine has paced the field in unit heating. Every model provides perfect heating comfort plus lowest possible fuel cost. This balanced heating is the result of the discharge temperatures of 110 to 120° F being correctly related to heat throw and air volume. For the complete story, see the Modine representative listed in your classified telephone directory, or write today for Bulletin 154.

Modine gas-fired unit heaters cost less to install, less to operate

In addition to greatly extended life, Modine Gas-Fired Unit Heaters cost less to install. That's because they're only half the weight, half the size of other leading units. And this lighter weight—coupled with direct firing of tubes and reduction of heat exchanger mass—gives you heat within 5 seconds of thermostat's call. Write for Bulletin 654. Modine Mfg. Co., 1509 DeKoven Avenue, Racine, Wisconsin.

U-1247

Modine UNIT HEATERS



① Self-oiling composition bushing feeds oil to shaft by capillary action.

② Bushing has shoulder which provides self-lubricating bearing surface for collar.

③ Slotted Bolt Holes. Rubber grommets can be used for sound isolation.

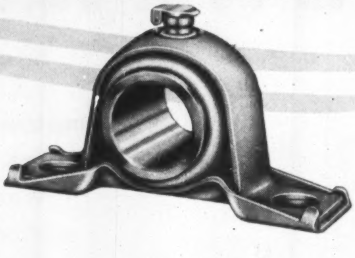
④ Absorbent filler holds oil in reservoir and prevents over-lubrication.

⑤ Split Pressed Steel Housing is light and strong.

⑥ Spherical surfaces provide full self-alignment.

DODGE
Bronzoil
FAN AND BLOWER BEARINGS

Proved
in Millions of installations!



Engineered to meet the specialized requirements of fan and blower service, Dodge Bronzoil bearings are widely and successfully used on small shafts for general service, within the limits of their capacity. Capillary bronze bushing has a capacity of one-third its volume in oil. The liberal oil reservoir, with close fitting wick, surrounding the bushing provides ample lubrication. Millions of Bronzoil bearings have proved their dependability through years of service. Available in shaft sizes from 3/4″ to 1 1/4″. Write now for literature and detailed information.

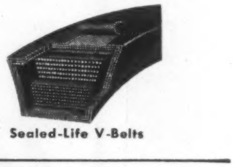
DODGE MANUFACTURING CORPORATION, 1600 Union St., Mishawaka, Ind.

DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory-trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified telephone book.

Dodge-Timken Bearings

Taper-Lock Sheaves



Sealed-Life V-Belts

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,
CHICAGO THRIFT-ETCHING CORPORATION, 1555 N. SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

Marlo

air conditions

new home of

VERNOR'S GINGER ALE

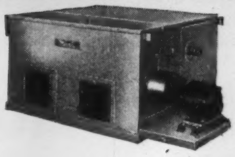
Architects and Engineers:
Harley, Ellington & Day
General Contractor:
Perron Construction Co.
Air Conditioning Contractor:
American Refrigerating Co.

The magic of remodeling has transformed an older Detroit building into a handsome new main office and bottling plant for the James Vernor Company, producers of Vernor's Ginger Ale.

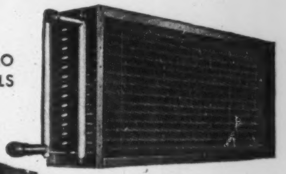
A striking combination of enameled glass and porcelain makes this architectural and construction masterpiece one of the most eye-catching structures on famed Woodward Avenue.

Air conditioning, of course, ranked high in the plans for modernization, and Marlo equipment exclusively was chosen for the important year-round comfort-conditioning job.

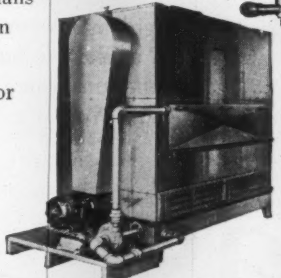
Whatever *your* air conditioning problems—large or small, simple or complex—you'll find the answer in the complete line of Marlo equipment.



MARLO AIR HANDLING UNITS



MARLO COILS



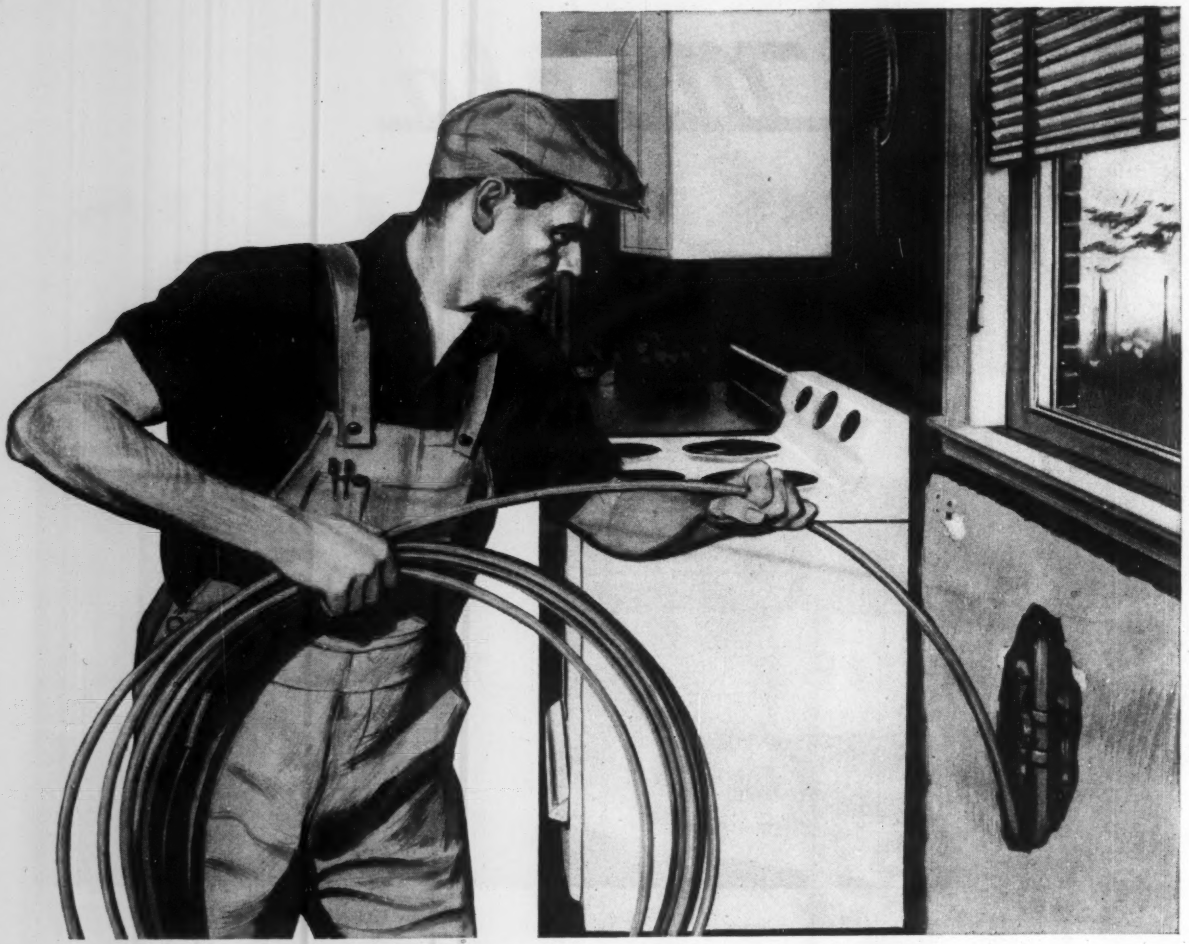
MARLO EVAPORATIVE CONDENSERS AND COOLING TOWERS

Write today for information and literature

Marlo
COIL COMPANY

Manufacturers of COOLING TOWERS • EVAPORATIVE CONDENSERS • INDUSTRIAL COOLERS • AIR CONDITIONING UNITS • MULTI-ZONE UNITS • BLAST HEATING & COOLING COILS

Saint Louis 10, Missouri



REPLACE rust-clogged pipes WITH COPPER

You can do your next replacement job easier, better . . . and *faster*, by using Chase Type K Soft Temper Copper Water Tube.

Chase Type K Soft Temper Copper Water Tube works easily through small openings, around corners . . . from an easy-to-handle coil. In replacement installations, there's no need to rip out whole walls. You simply fit Chase Copper Water Tube right alongside the old pipe!

Because Chase Copper Water Tube is available in coils up to 100 feet in length, you reduce the number of joints and save the cost of many fittings.

For replacement jobs—or brand new installations—use the water tube that can *never* clog with rust—Chase Copper Water Tube.

Contact your Wholesaler for Chase Soft Temper or Hard Temper Copper Water Tube and a complete line of Chase Copper Tube Fittings.

Chase®
BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Albany†
Atlanta
Baltimore
Boston
Chicago
Cincinnati
Cleveland
Dallas
Denver†
Detroit
Houston
Indianapolis
Kansas City, Mo.
Los Angeles
Milwaukee
Minneapolis
Newark
New Orleans
New York
Philadelphia
Pittsburgh
Providence
Rochester†
St. Louis
San Francisco
Seattle
Waterbury
(†sales office only)

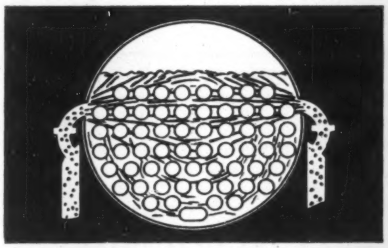
Located in the world-famous Country Club Plaza district of Kansas City, Putsch's Cafeteria has a reputation as one of the finest eating places in the United States.

Architect—Edward W. Tanner & Associates; Builders—J. C. Nichols Company; Heating Contractor—Inter-State Heating & Plumbing Company; all of Kansas City, Mo.

Putsch's Cafeteria wins national award... uses Pacific Boiler with *Jet-action* Circulation!

For exceptional design and decor, and the highest standards of sanitation, food preparation and service—Putsch's Cafeteria, Kansas City, Mo., received First Award in Institutions Magazine's Annual Food Service Contest. Many consider Putsch's the finest cafeteria in the world!

Diners can park above the cafeteria, walk down, and enjoy superb food at family prices . . . in an atmosphere tempered by a Pacific Boiler with *Jet-action* Circulation.

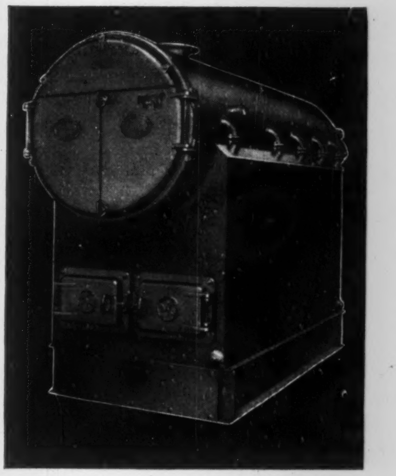


Exclusive *Jet-action* Circulation

Increases heat transfer, saves fuel!

Putsch's Pacific Boiler with *Jet-action* Circulation gives more heat for a given amount of fuel than any other boiler of the same capacity. Pacific's exclusive circulating connections project hot water and steam across the heating tubes at high speeds; heat-insulating bubbles are swept away—and kept away. Tubes transfer heat faster . . . fuel consumption is lowered . . . response is practically immediate when a change in temperature is desired.

Take a tip from the national award winner, Putsch's—the only cafeteria in the United States to receive such honor this year. Improve your installations and assure your customers greater satisfaction with Pacific Boilers. Available in all sizes, using all fuels, for any type building. For engineering data, catalogs or any other information, call your local Pacific representative.



A Pacific High Firebox Boiler heats Putsch's Cafeteria. When temperature change is desired, *Jet-action* Circulation makes response practically immediate.

Designed Constructed and Stamped in Accordance with ASME Code

UNITED STATES RADIATOR CORPORATION: Boilers, Radiators, Heating Accessories • Pacific Boilers • Cyclotherm Steam Generators • Metal Products • Drayer-Hanson Air Conditioning and Commercial Refrigeration

Pacific Steel Boiler
DIVISION • UNITED STATES RADIATOR CORPORATION
GENERAL OFFICES DETROIT 31, MICHIGAN

Ultra-Modern Design

Administration and Research Center
S. C. Johnson & Son, Inc., Racine, Wis.
Architect: Frank Lloyd Wright
Consulting Mechanical Engineers:
Samuel R. Lewis & Associates

...fired by **coal**

In the famous plant of Johnson's Wax, modern equipment makes coal a clean and automatic fuel . . . and saves dollars year after year.

Says: Adrian Wilson, Power Plant Assistant Manager
S. C. Johnson & Son, Inc.
Racine, Wisconsin

"Our plant uses an average of 900 tons of coal per month. At the conclusion of a recent analysis of relative fuel costs, we were unable to justify a change from coal to any other fuel. In burning coal the modern way, we have steadily improved the efficiency of our power plant."

•

If you plan to modernize—or to build a new plant, be sure to investigate the convenience and money-saving advantages of coal when burned with modern equipment.

You can enjoy automatic operation and save on labor by installing up-to-date coal-feeding and ash-handling systems. And you can eliminate dust or smoke nuisances with such devices as dust collectors and cinder rejectors. Often such equipment can pay for itself in fuel and labor savings in only a few short years.

Get the advice of a consulting engineer. He can make a fuel analysis for you. He can advise you on what equipment can best fill your specific needs and return you a big saving year after year with coal.

YOUR BEST BUY IS BITUMINOUS

- ✓ **Today's lowest-cost fuel,** in most places, is Bituminous Coal!
- ✓ **The most stable fuel in price is coal,** because coal reserves are virtually inexhaustible . . . coal mining is highly mechanized.
- ✓ **The safest fuel to store and use is coal.**
- ✓ **Your best bet for saving dollars is coal** . . . for modern equipment greatly multiplies coal's inherent advantages.

Additional case histories, showing how other types of plants have modernized and saved money by burning coal with modern equipment, are available upon request.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
Southern Building, Washington 5, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

BARBER COLMAN

"UNI-FLO" ENGINEERED

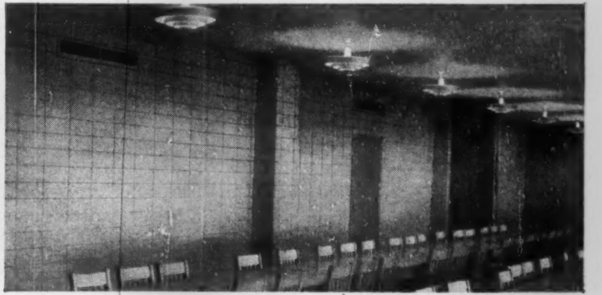
Air Distribution

. . . provides comfort for mental patients at huge Indiana institution . . .

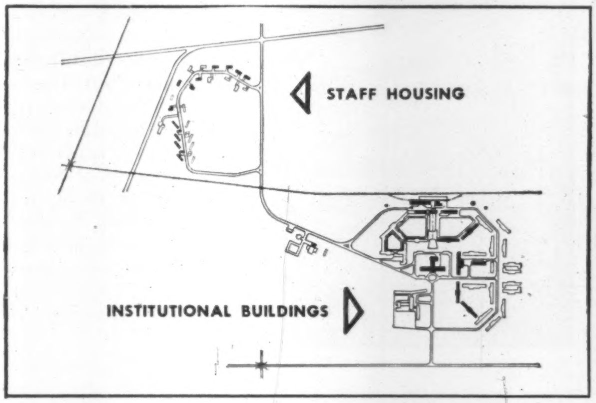
Nearing completion at Westville, Indiana, is one of the world's largest institutions for the mentally ill. Since 1949 most of the thirty-four large buildings, plus staff residences, have been constructed at a total cost of nearly $25,000,000. The institution contains a small city within itself with provision for housing, feeding, working, and recreational facilities for 3,250 patients and 450 employed personnel. Air distribution in most of the project has been engineered with Uni-Flo equipment to assure comfort conditions for the patients and staff members. Over 2,500 pieces of Uni-Flo equipment have been specified or installed in various buildings.

Architects, Engineers, Interior Designers: Boyd E. Phelps, Inc., Michigan City. *General Contractors:* Tonn & Blank, Michigan City; E. H. Marhoefer, Jr. Co., Permanent Construction Company, and Gordon & Company, Chicago. *Ventilating Contractors:* Troeger Sheet Metal and Zack Incorporated, South Bend; Industrial Sheet Metal, Hammond; Reliable Sheet Metal, Chicago.

Disturbed Unit houses violently insane patients. Uni-Flo Sidewall Diffusers in soffit distribute air quietly and uniformly. Each Diffuser is furnished with tamperproof screws.



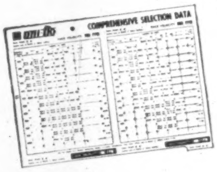
Aged and Infirm Unit has dining area handling eighty patients at one time. Facilities are available for serving eight hundred patients in various units simultaneously. Uni-Flo Sidewall Diffusers are installed high on the walls.



Huge size of project is indicated by sketch. Included are dormitories, a hospital, laundry, kitchens, auditorium, greenhouses, occupational and recreational units, cold storage, warehouses, power and sewage plants, plus a separate personnel building and individual staff residences.

Spacious Auditorium has every modern facility for musical therapy treatments, plus entertainment of patients. Venturi-Flo Ceiling Diffusers (individually adjustable) provide a healthful, comfortable, draft-free atmosphere without distracting air noise.

BLAZING THE TRAIL *TO BETTER AIR DISTRIBUTION*



First to publish reliable data . . .

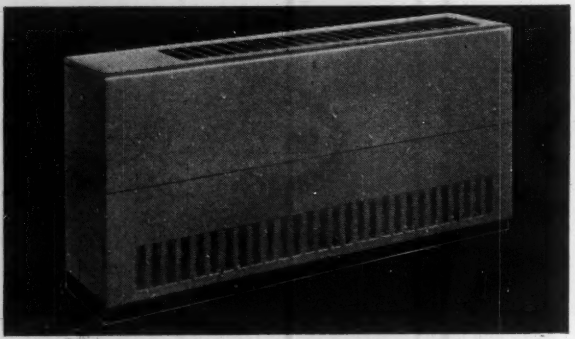
Performance data on air distribution equipment was meager and incomplete just twenty years ago. Pioneer work on this subject in the Barber-Colman laboratories was the basis for comprehensive engineering data, now time-proved and widely used to determine, in the layout stage, the exact requirements for any desired conditions.

Research, development, and testing facilities are fundamental requirements and the responsibility of manufacturers to assure progress in the field of air distribution. Complete information about Barber-Colman's reliable selection data is available from our nearby Field Office (consult phone directory) or by writing us.

BARBER-COLMAN COMPANY, Dept. I, 1101 Rock St., ROCKFORD, ILL., U.S.A.

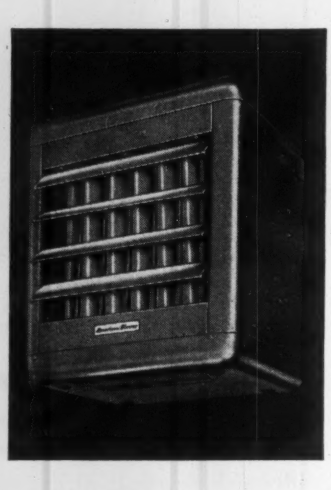
Choose the heater that fits *your* job best!

American Blower offers you a *complete line* of commercial and industrial unitary-type heaters for maximum flexibility in layout and design!



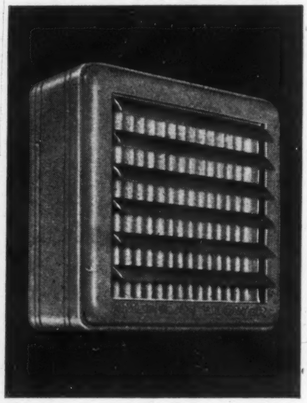
Looking for an attractive and efficient unit heater for your lobby? Office? Showroom? Corridor? Then install American Blower **De Luxe Cabinet Unit Heaters** for steam and hot-water systems! Recessed and non-recessed types for ceiling or floor installation. Finished in attractive gray-green baked enamel. Five basic sizes; permanent or disposable filters.

You can't go wrong if you (1) plan to use gas as fuel on your next heating installation, and (2) use American Blower **Gas-Fired Unit Heaters!** They're compact and modern in design; come in both conventional and duct types, to let you tackle any size job. Use them individually or in combination; easy to install, economical to operate. Capacities: 50,000 to 230,000 BTU/hr input.



AMERICAN BLOWER

Equitemp Air Diffuser on new **Venturafin Vertical Unit Heaters** is adjustable, and permits an even flow of heat. It produces a cone of heated air that mixes with room air—for breathing-level temperatures that vary less than one degree! Anemostat and vane-type diffusers also available. 58,400 to 560,000 BTU at 2 psig, 60°F. entering air.



If you want *both* low price and top heating performance, put in American Blower's new **Venturafin Horizontal Unit Heaters!** They're truly quiet, and have separate coil systems for hot water and steam. Serpentine design of hot-water coils increases output; permits use of smaller units in many cases. Capacities: 18,000 to 357,500 BTU at 2 psig, 60°F. entering air.

* * *

For complete data on American Blower unitary-type heaters, jot down your request on a post card and mail it to: American Blower Corporation, Detroit 32, Mich. Better yet, step into your American Blower jobber's and see them for yourself—today!

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN • CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

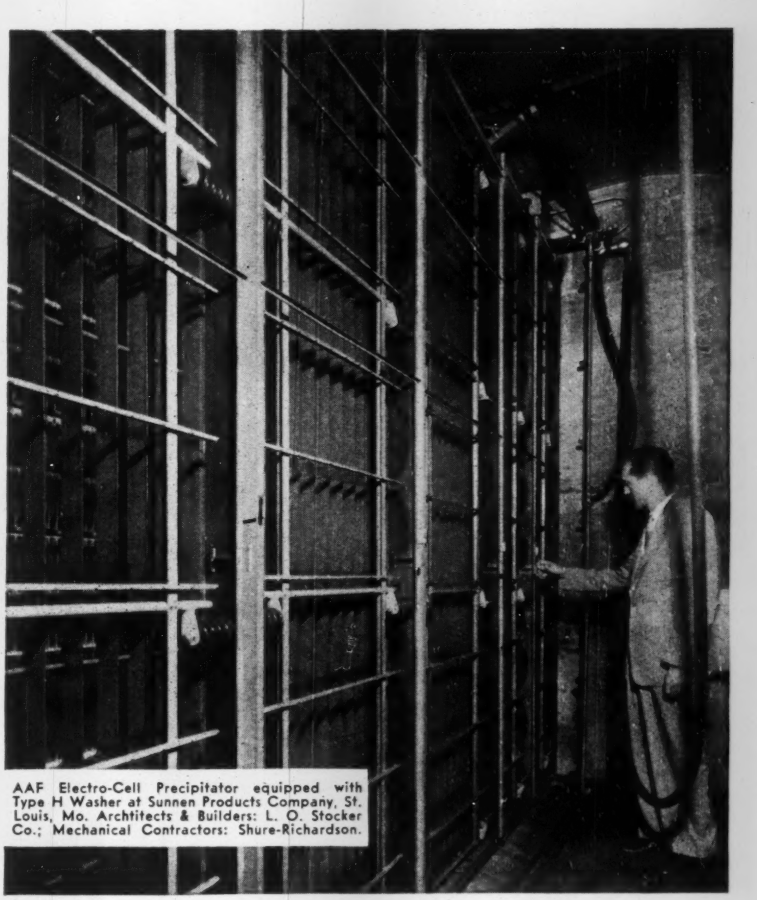
AMERICAN BLOWER

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

SUNNEN

SELECTS AAF PRECIPITATOR THAT

Washes its Face Automatically!



AAF Electro-Cell Precipitator equipped with Type H Washer at Sunnen Products Company, St. Louis, Mo. Archtitects & Builders: L. O. Stocker Co.; Mechanical Contractors: Shure-Richardson.

Electro-Cell Precipitator with Type H Washer supplies super-clean air for office and plant of St. Louis manufacturer

As manufacturers of quality automotive maintenance equipment, Sunnen Products Company are "precision minded". They wanted filters that would deliver super-clean air continuously without the constant "mothering" of a maintenance crew. Their logical selection—the AAF Electro-Cell Precipitator with Type H Washer.

Dust, soot and even smoke are "easy pickin's" for the high efficiency Electro-Cell Precipitator. With the addition of the Type H Washer the complete cleaning operation is done automatically with the mere push of a button.

Easy? Let's push the button and see what happens. First, the spray header moves back and forth across the face of the plate cells, washing away the accumulated dust and dirt. After a five-minute drying period, an adhesive coating is applied to the clean collector plates through another set of spray nozzles mounted on the traveling header. Each operation is automatically timed. Each side of each plate receives a thorough washing and even application of adhesive over its entire depth. That one press of the button does the *complete* cleaning job.

A high efficiency precipitator with a dependable, always available maintenance crew "built-in"—that's the AAF Electro-Cell with Type H Washer. For complete product information, call your local AAF representative or write direct.

AAF

American Air Filter

COMPANY, INC.

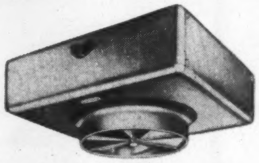
American Air Filter of Canada, Ltd., Montreal, P. Q. • 373 Central Avenue, Louisville 8, Kentucky

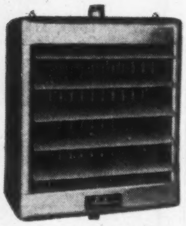
National Biscuit Company
Chicago, Illinois

Architect: Alexander D. Crossett, New York, N. Y.
General Contractor: Ragnar Benson, Inc., Chicago, Ill.
Heating Contractor: Robert Gordon, Inc., Chicago, Ill.

NATIONAL BISCUIT COMPANY
NABISCO

Airtherm





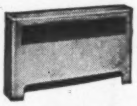
90 VERTICAL DISCHARGE HEATERS INSTALLED from 102,500 BTU to 185,000 BTU

92 HORIZONTAL DISCHARGE HEATERS INSTALLED from 14,800 BTU to 250,000 BTU

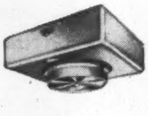
STEAM UNIT HEATERS
WARM THE WORLD'S LARGEST BAKERY

To achieve flexible, economical heating throughout Nabisco's new $20 million Chicago plant, 182 Airtherm steam unit heaters have been installed. The plant is the world's largest cracker and biscuit bakery with ovens the length of football fields, almost 20 acres of floor space and a capacity of 167 million pounds yearly.

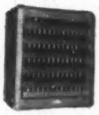
When the area to be heated presents unusual problems, chances are you can solve them easily and economically with the flexibility of Airtherm unit heaters.



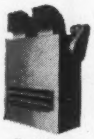
Convectors



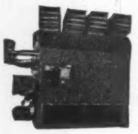
Vertical Steam Unit Heaters



Horizontal Steam Unit Heaters



Centrifugal Fan Type Unit Heaters



Direct Fired Space Heaters

Gas Fired Unit Heaters

FOR HEATING SATISFACTION . . . THINK FIRST OF

Airtherm

MANUFACTURING COMPANY
711 South Spring Avenue • St. Louis 10, Missouri

How a KEWANEE Reserve Plus Rated boiler...

stepped up production 100%

cut fuel costs 50%

Duracrete Block Company, Inc., Hooksett, New Hampshire

■ Anyone would find it difficult to prove to Dante V. Donati, Manchester, New Hampshire, that Kewanee Reserve Plus Rated Boilers do not pay dividends. That's because he discovered it the hard way. First, he bought an ordinary boiler for his plant at the Duracrete Block Company. He operated it one year, and then . . . but let him tell the story—

"We installed an ordinary boiler and found it to be inadequate. We then purchased a Kewanee Unit. Our production was stepped up more than 100% . . . with fuel costs cut in half. Maintenance cost is extremely low. The quality of our product has improved because of lower moisture content due to ample steam for processing."

Judging from Mr. Donati's experience it just makes sense that it's money in the bank to follow the Kewanee Reserve Plus Rating Plan in selecting a boiler. So when you choose a boiler, know these important facts:

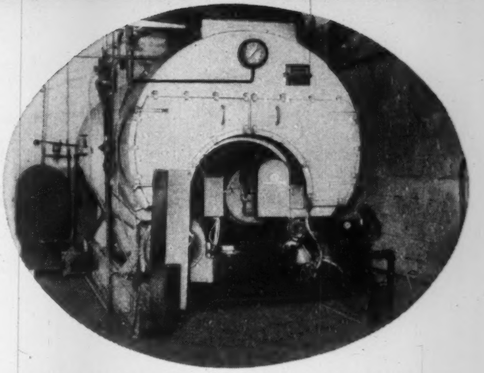
1—*Boiler rating must be based on nominal capacity, not maximum capacity;*

2—*Boilers must have sufficient built-in reserve to meet changing demands;*

3—*Boilers must have sufficient capacity to operate at "cruising speed," not maximum speed at all times;*

4—*Like examples must be considered in comparing boilers. Don't be confused by vague technical claims.*

Choose Kewanee and cut fuel costs—lower maintenance—reduce breakdowns—get longer boiler life.



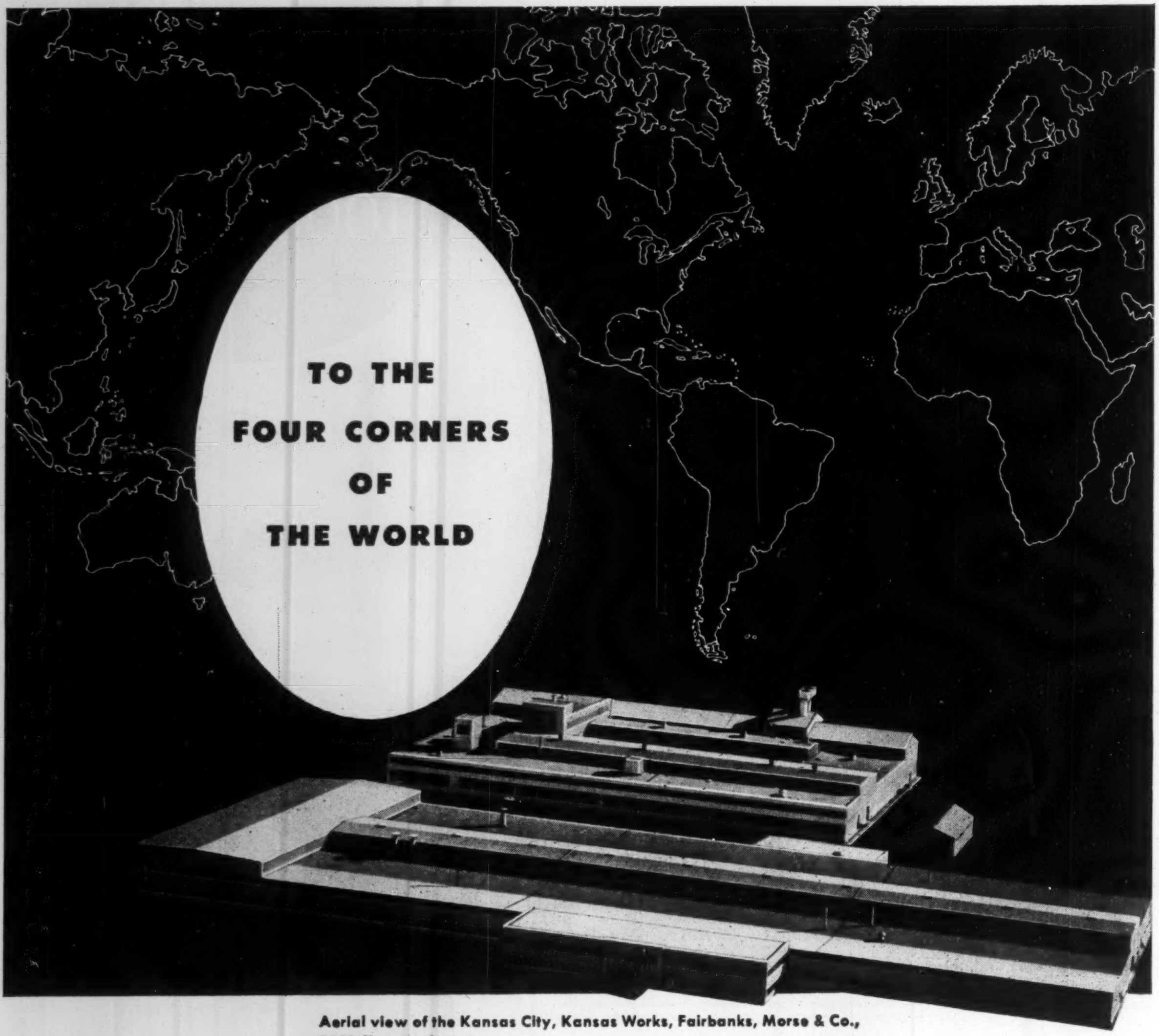
Here is No. 85-60 Kewanee Oil Fired Boiler-Burner Unit installed at the Duracrete Block Company.

KEWANEE BOILERS

KEWANEE-ROSS CORPORATION, Kewanee, Illinois
Division of American Radiator & Standard Sanitary Corporation

Serving home and industry · American-Standard · American Blower
Church Seats & Wall Tile · Detroit Controls · Kewanee Boilers
Ross Exchangers · Sunbeam Air Conditioners

YOU can depend on KEWANEE engineering



Aerial view of the Kansas City, Kansas Works, Fairbanks, Morse & Co., 3601 Kansas Avenue.

...from Kansas City

Yes, from our new, modern-as-tomorrow works at Kansas City, we serve the world's needs for pumps.

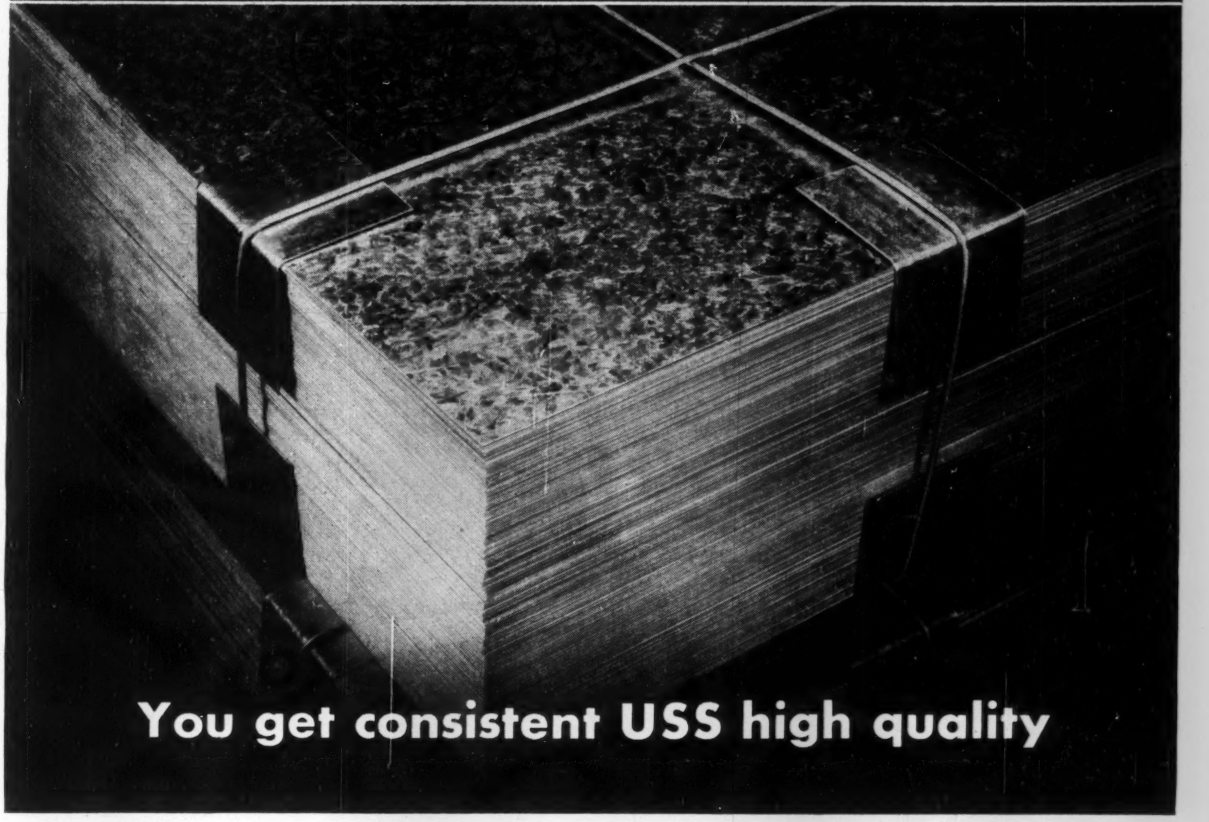
As a major supplier of quality pumping equipment, it is particularly suitable that this new Fairbanks-Morse plant be located at an important crossroads of the world . . . Kansas City. In this new plant 190,000 square feet of manufacturing space and a complete foundry occupying 150,000 square feet are devoted to bringing better service to our customers all over the world.

Modern manufacturing, development and testing equipment backed by engineering and production skills of highly trained personnel combine to produce products of unmatched quality . . . in performance, durability, economy. Fairbanks, Morse & Co., Chicago 5, Illinois.

FAIRBANKS-MORSE
a name worth remembering when you want the best

PUMPS • SCALES • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY • RAIL CARS • HOME WATER SERVICE EQUIPMENT • FARM MACHINERY • MAGNETOS

WHY IT PAYS TO BUY SHEETS and STRIP FROM US



You get consistent USS high quality

- All the sheets and strip that we sell are the dependable, top quality products of United States Steel—manufactured under close quality control that insures uniformity. And we, at U. S. Steel Supply, make certain that their quality is intact when you get your order . . . our sheets and strip are stored right and bundled right to arrive in top shape.

Each U. S. Steel Supply warehouse has ample stocks of steel sheets and strip of various types, grades and sizes to fill your orders promptly, exactly.

Next time you want good, dependable steel with service to match, contact U. S. Steel Supply. Call us for: hot rolled, cold rolled, Vitrenamel, galvanized, galvannealed, paint bond, corrugated, long terne sheets, and hot rolled or cold rolled strip.

TRIPLE SECURITY

What you want
When you want it
At the **right price**

U. S. STEEL SUPPLY

DIVISION

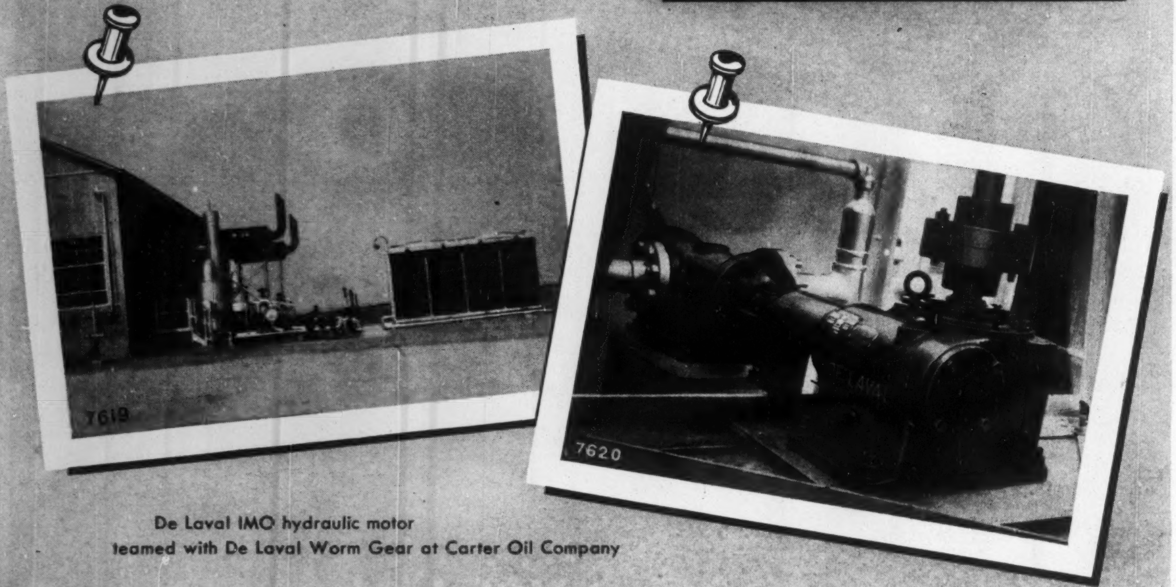
General Offices
208 So. La Salle St., Chicago 4, Ill.

Warehouses and Sales Offices
Coast to Coast

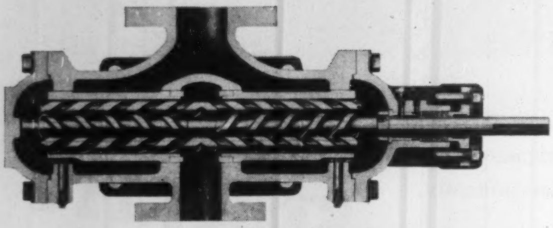
UNITED STATES STEEL

More than two years of trouble-free service with

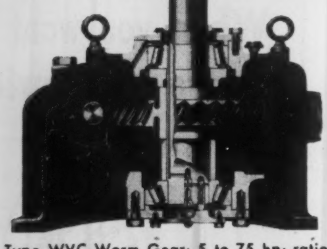
DE LAVAL IMO
HYDRAULIC FAN DRIVE



De Laval IMO hydraulic motor teamed with De Laval Worm Gear at Carter Oil Company



De Laval IMO A324A hydraulic motor. Capacities to 200 gpm; temperatures to 250 F; pressures to 500 psig.



De Laval Type WVC Worm Gear; 5 to 75 hp; ratios 3⅝:1 to 11⅔:1; center distance 4.00" to 13.50".

De Laval IMO hydraulic motors and pumps have operated twenty-four hours a day for over two years on the Happy Cooling Tower at the Carter Oil Company, Elmore City, Oklahoma Compressor Station.

Fans are driven through De Laval WVC Worm Gear Reducers. There is absolutely no vibration or noise. The equipment has yet to require maintenance of any consequence. Indications point to a long, trouble-free life expectancy.

Here's why De Laval IMO Hydraulic Drives insure trouble-free service. The IMO hydraulic motor has no bearings, no reciprocating parts, no vanes, no timing gears, no intricate sub-assemblies. The drive is in complete hydraulic balance. The simple basic IMO design has only three moving parts.

Call in your De Laval representative. He can solve your problem quickly in the application of De Laval completely standard hydraulic motors, pumps and worm gear reducers. Or, ask your heat exchanger supplier to specify De Laval drives.

DE LAVAL *Hydraulic Drives*

DE LAVAL STEAM TURBINE COMPANY
871 Nottingham Way, Trenton 2, New Jersey

DL-235

TRION

ELECTRONIC AIR CLEANERS

have the *leadership features* you need in modern air cleaning!

TRION

GUARANTEED AIR CLEANING EFFICIENCY OF 90% BY U. S. BUREAU OF STANDARDS DUST-SPOT TEST METHODS

plus

BUILT-IN WATER WASH SYSTEMS

Trion pioneered the built-in water wash system for easy and effective removal of collected dirt. Ionizers, insulators, collecting cells and air distribution media can be easily cleaned without entering the duct.

plus

UNITIZED IONIZING-COLLECTING CELL

Trion units are built with an all-aluminum ionizing-collecting cells with a venturi nozzle to prevent by-pass. The corona shield construction conserves power and increases efficiency.

plus

BUILT-IN DRY TYPE FILTERS

Dry type mechanical filters are built-in on the clean air side of each Trion unit to provide effective air distribution—another Trion first.

plus

MODERN POWER PACKS

Trion leads the field in modern power packs that feature accurate indicating instruments and fully magnetic circuit breaker assuring absolute control of operation.

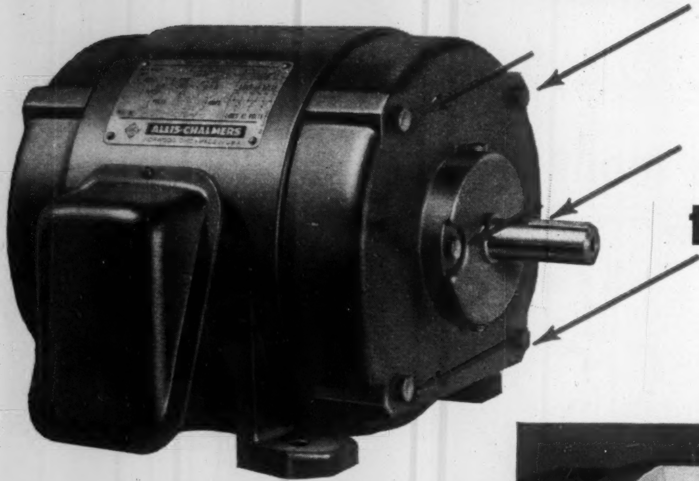
Write for the Free TRION Catalog E-60—
it has the facts you want!

TRION

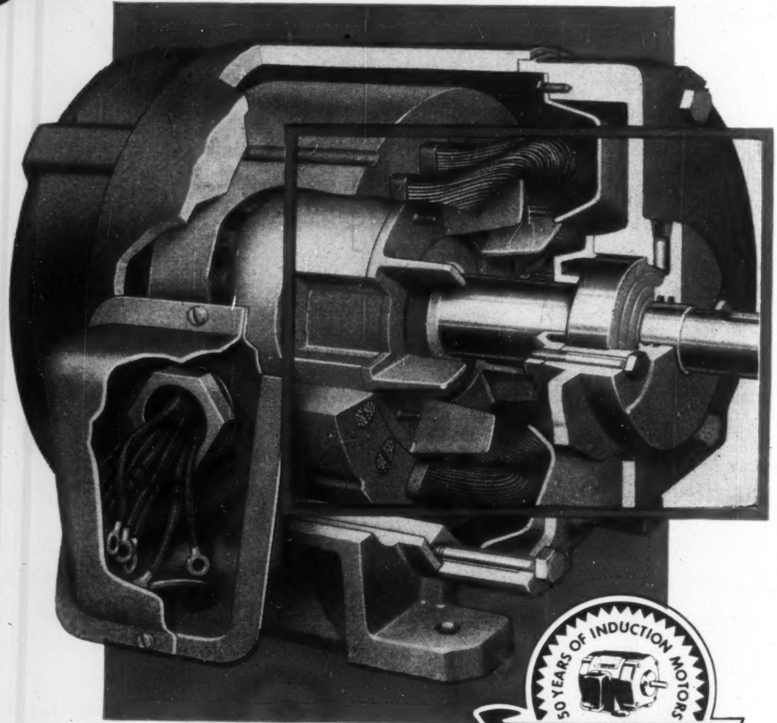
TRION, INC.
1000 Island Avenue • McKees Rocks, Pa.
IN METROPOLITAN PITTSBURGH

Here's motor superiority

you can see



It takes 6 bolts
not just 4
to give full bearing
protection



THE TWO EXTRA BOLTS in the end housing of every Allis-Chalmers ball bearing motor are the proof of *extra* protection against bearing failure. These are the bolts that hold the bearing cap tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, keeps grease from the interior of the motor . . . retains an ample supply within the bearing enclosure . . . protects the grease and the bearing against contamination from dirt and moisture.

At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt traps.

Result? Allis-Chalmers motors pay off in longer, trouble-free bearing life, lower motor maintenance.

50 YEARS OF INDUCTION MOTORS
ALLIS-CHALMERS·NORWOOD WKS.

Get all the facts . . . judge for yourself — Compare Allis-Chalmers motors with other motors. Get the six-bolt construction that gives you complete bearing protection. For proof, see your Allis-Chalmers Office or Authorized Distributor, or write — Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

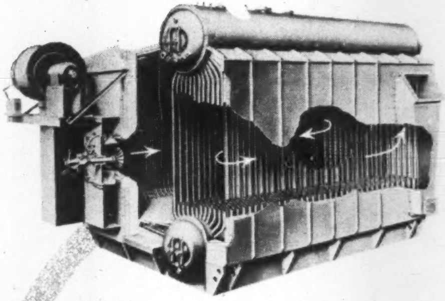
A-C
ALLIS-CHALMERS

A-4440

STANDARD BOILERS THAT SET INDUSTRY STANDARDS

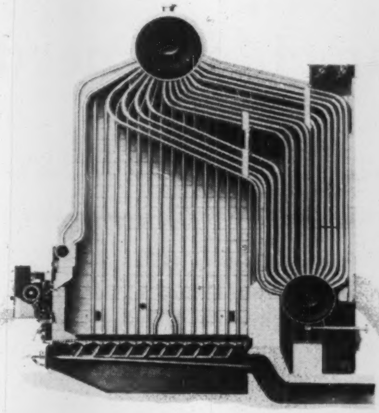
Whatever your steam needs, in the complete C-E line of fuel burning and steam generating equipment, you will find a type and size just right for you.

In the moderate capacity range, for example—from 4,000 to 120,000 pounds of steam per hour—the three *standardized* C-E Boilers shown here offer advantages of economy and performance that make them standout values in a wide range of applications.



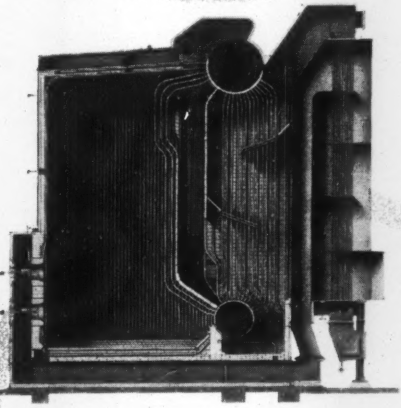
C-E Package Boiler, Type VP

4,000 to 40,000 lb steam per hr . . . pressures to 500 psi . . . for pressure firing of oil or gas . . . completely shop-assembled, needs only simple concrete slab for foundation. Has more water-cooled area per unit of furnace volume than any other boiler of its size and type. Large lower drum permits simple, symmetrical tube arrangement . . . great water storage capacity . . . easy access. Low-speed centrifugal fan is unusually quiet in operation. Simple baffle arrangement means low draft loss . . . simple soot blowing . . . no dead pockets . . . high heat absorption.



C-E Vertical-Unit Boiler, Type VU-10

10,000 to 60,000 lb steam per hr . . . pressures to 475 psi . . . superheat to 200 F in larger sizes . . . for coal, oil or gas . . . bottom-supported, needs no outside supporting steel. Boiler is efficient over a wide range of output, and is easy to operate and maintain. All parts are readily accessible for inspection. Regardless of fuel, the same general cross-sectional arrangement of drums, convection bank and furnace cooling is used. Uniform design through each transverse section assures even water level in drum, and uniform expansion.



C-E Vertical-Unit Boiler, Type VU-55

50,000 to 120,000 lb steam per hr . . . pressures of 250 or 500 psi . . . superheat and heat recovery equipment if desired . . . for oil or gas . . . bottom-supported, needs no outside supporting steel. This boiler is of symmetrical design. Thus gas temperature is constant across the full boiler width. The narrow, high furnace . . . integral design of boiler and preheater . . . absence of exterior ductwork . . . compactness—all help the VU-55 achieve standards of performance closely approaching that of large central station boilers.

Other C-E Industrial Boilers

In addition to the standard boilers shown here, Combustion offers many other 2-drum designs, for capacities to 350,000 pounds of steam per hour, for any commercially available fuel, for pressures to 1375 psi, and temperatures to 960 F. Heat recovery equipment is available. So — whatever your steam needs — call Combustion for details on the complete line of C-E Industrial Boilers.

B-767B

COMBUSTION ENGINEERING

C-E

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE

How Honeywell Customized Temperature Control helps provide

The kind of "Indoor Weather" your clients need

Customized Temperature Control installation at Corning Glass Center is a good example.

AT THE Corning Glass Center in Corning, New York, you'll find a museum, offices, shops—and production areas where Steuben glassware is made.

Such a variety of functions under one roof calls for scientific temperature control—if the "indoor weather" is to be comfortable throughout the building.

Today the best way to provide proper "indoor weather"—whether a building houses one function or many—is through the use of *Honeywell Customized Temperature Control.*

The key word here is "customized". It means that whatever your clients' control requirements, a Honeywell Customized Temperature Control installation *designed to fit the needs of the building and its occupants is your answer.* This applies not only to heating and cooling, ventilating and humidity control—but to industrial control as well.

Only Honeywell can provide true "customized" control. Because only Honeywell manufacturers all three types of controls—pneumatic, electric and electronic.

The story, in brief form, of the Honeywell Customized Temperature Control installation in the Corning Glass Center is told by the floor plan and picture captions you see here.

They tell how specific occupancy, use and exposure problems were met.

The *techniques* used, applied to your particular problems, can help you give your clients the "indoor weather" they've always wanted.

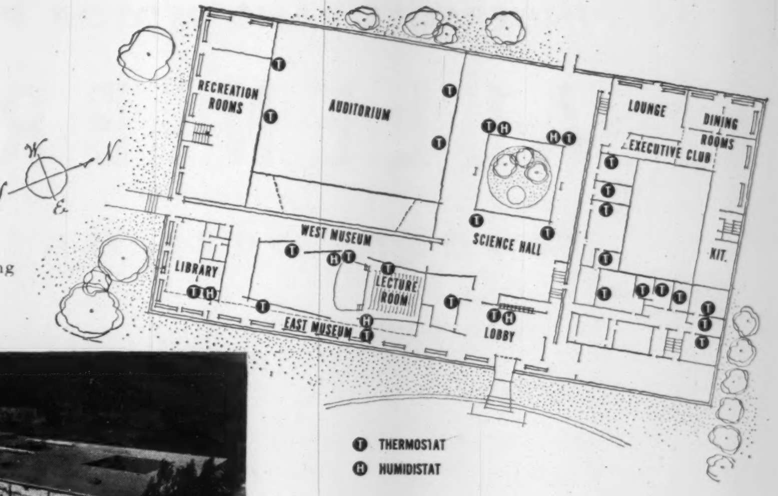
Interior garden of Corning Glass Center

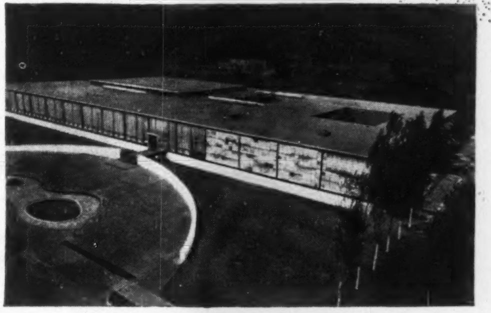
GLASS FOR LIVIN

Architects: Harrison,
Abramovitz and Abbe,
New York, N. Y.

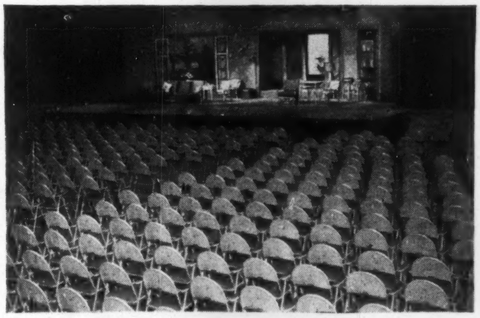
Mechanical and Electrical
Consulting Engineers:
Jaros, Baum and Bolles,
New York, N. Y.

Air Conditioning Consulting
Engineers: Henry Peck
Associates, Fairport, N. Y.





This panorama of the Corning Glass Center shows the temperature control problems involved. Huge glass window areas face four directions. Whether it is sunny or cloudy makes a big difference to the heating and cooling system. But Honeywell Customized Temperature Control, using electronic and pneumatic thermostat and humidistats, keeps the building comfortable all the time.



Interior heating and cooling factors are important, too. Take the auditorium above, for instance. With a large crowd you have one heating problem. With a small group, quite another. But the four Honeywell thermostats located here handle either situation easily.

The internal heating problem in the display room above is somewhat similar to that of the auditorium. But when it is crowded (requiring little heat) the auditorium might need considerable heat. Yet with enough thermostats, strategically placed, both areas are comfortable.

For comfortable, even temperature in new or existing buildings—of any size—specify Honeywell Customized Temperature Control

Whether it's a factory, motel, hospital — or any building of any size — new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems. You can give your clients more comfort and efficiency. And they'll save fuel, too.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. Or mail the coupon today.

James M. Brown, III, director of the Corning Glass Center, says:

"Today our Glass Center is one of the most comfortable buildings in the country. Important in helping make possible this comfort is our Honeywell Customized Temperature Control installation."

MINNEAPOLIS
Honeywell

H HONEYWELL

First in Controls

112 OFFICES ACROSS THE NATION

Minneapolis-Honeywell Regulator Co.
Dept. HA-9-60, Minneapolis 8, Minnesota
Gentlemen:

I'm interested in learning more about Honeywell Customized Temperature Control.

Name ....

Firm Name ....

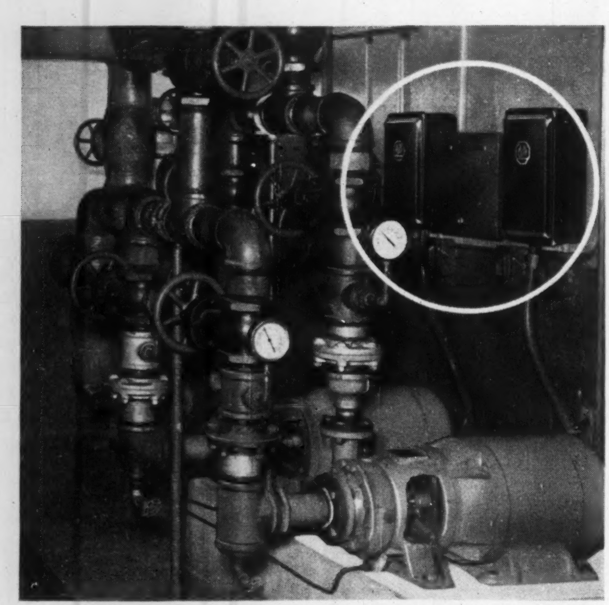
Address ....

City .... *Zone* .... *State* ....

INGERSOLL-RAND MOTOR PUMPS operated by

ALLEN-BRADLEY

TROUBLE FREE MOTOR CONTROLS


Two Ingersoll-Rand motor pumps, equipped with Allen-Bradley control, serving a cooling tower in a large office building.

● Why are Allen-Bradley automatic starters so popular for refrigeration and air conditioning service? . . . Because they are trouble free.

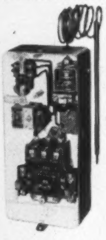
Why are they trouble free? Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them! No contact maintenance . . . Allen-Bradley cadmium silver alloy contacts never need cleaning, filing, or dressing.

Dependable overload relays . . . Allen-Bradley thermal relays are accurate and always dependable . . . even after years and years of service.

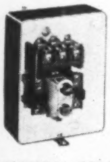
The Allen-Bradley trademark stands for millions of trouble free operations. Specify Allen-Bradley controls, today.

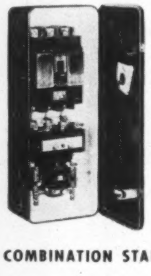
Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.

TYPICAL ALLEN-BRADLEY REFRIGERATION CONTROLS


SPECIAL REFRIGERATION CONTROL UNIT

PRESSURE AND TEMPERATURE CONTROLS


MANUAL STARTER

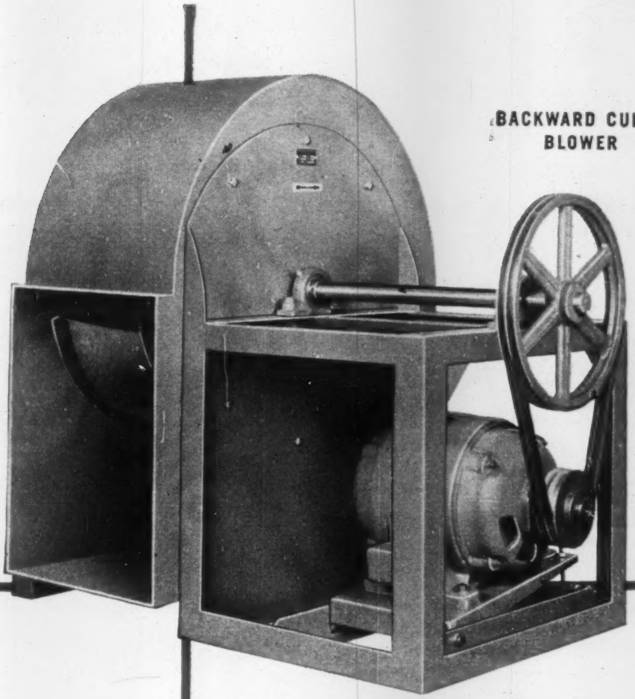

COMBINATION STARTER

A-B Quality

ALLEN-BRADLEY SOLENOID MOTOR CONTROLS

QUALITY MOTOR CONTROLS FOR HEATING, VENTILATING, AIR CONDITIONING, & REFRIGERATION INDUSTRIES

Peerless Blowers Designed For Your Needs



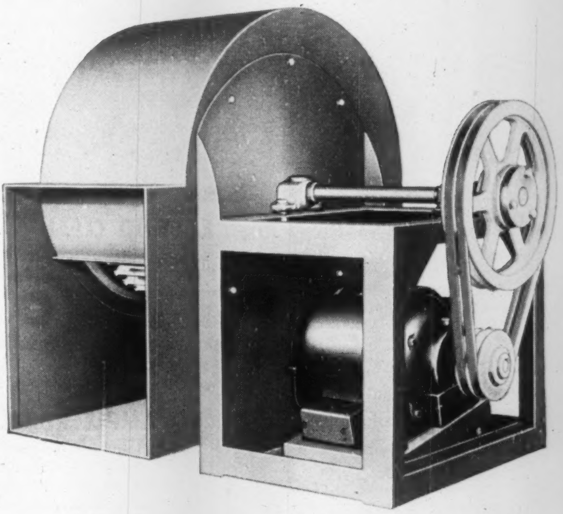
BACKWARD CURVE BLOWER

Price ✓
Delivery ✓
Engineering ✓
Quality ✓

Join the swing to Peerless—the complete line of fans and blowers that meets today's big construction demands. Dealers, distributors and contractors choose Peerless because Peerless gives them more, including free engineering help on tough, middle-size jobs.

Peerless manufactures all components in its products, including the motors. You get the advantages of undivided responsibility; fans and blowers that meet all NAFM standards; prices that are set and held competitively; and, top-flight trouble-free performance that boosts profits by eliminating costly call backs. Because Peerless has control of the entire process, you can get immediate delivery on any item in the big Peerless line.

Check and see; compare and prove that you buy best, sell best, install best and are served best when you deal with the fan and blower manufacturer that offers you most—Peerless.



BELT DRIVE UTILITY BLOWER

THE PEERLESS ELECTRIC CO.

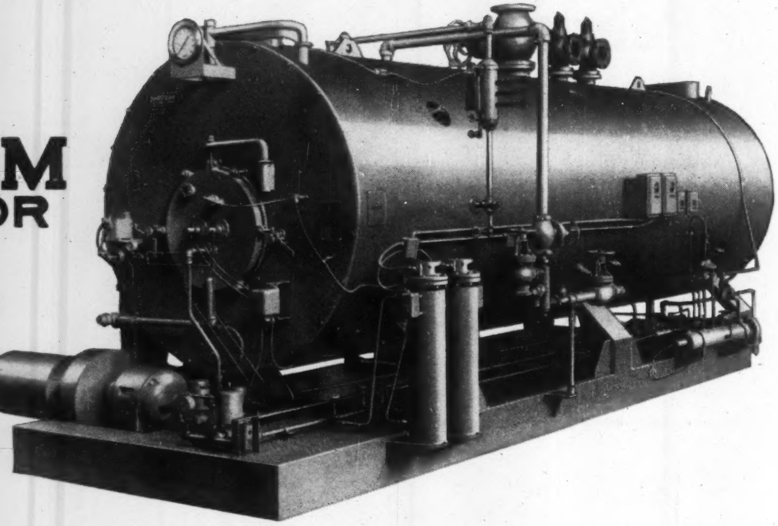
Peerless Electric

FAN AND BLOWER DIVISION
1409 WEST MARKET ST. • WARREN, OHIO

GET **ALL** THESE ADVANTAGES

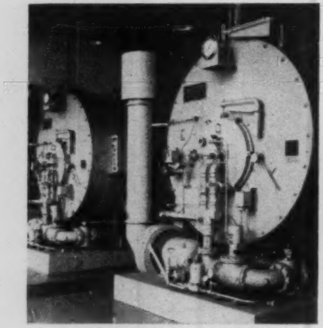
WITH AN

AMESTEAM GENERATOR



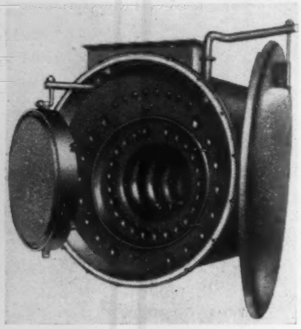
For:
PROCESSING
HEAT — POWER

20 sizes, 10 to 600 H.P., 15 to 200# W.P., oil, gas or oil-gas combinations with quick fuel switchover feature.



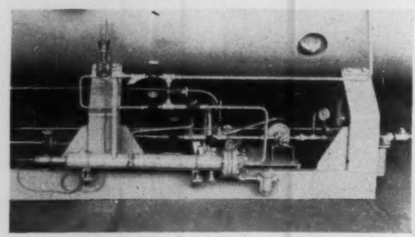
FULLY ASSEMBLED

All piping, wiring and operating parts completely assembled and tested at factory — units shipped in ready-to-fire condition!



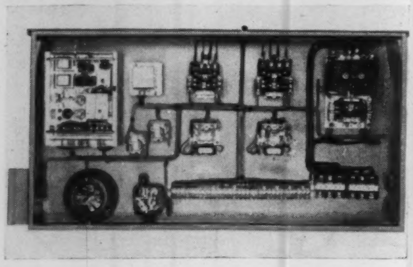
EASY TO CLEAN

Ames-designed davit hinged flue covers and baffle provide quick and complete access to the furnace and all tubes.



AMPLE ROOM

underneath for servicing auxiliary equipment. Control panel at eye level.



AUTOMATIC

operation, fully safeguarded, is provided by factory installed and tested control system.

SAVINGS IN FIRST COST!

Your purchase price includes complete unit — no hidden "extras" to buy later on!

SAVINGS AT INSTALLATIONS

Just set on level concrete floor, connect to service lines and breeching. Nothing to assemble. No brick work required.

SAVINGS IN OPERATION

A minimum of supervision — lower manhour requirements for maintenance — easily replaced inexpensive plastic refractories — 80% thermal efficiency.

Write for bulletin today!

AMES IRON WORKS, INC.
Oswego, N. Y., Box D-94

Gentlemen:

Please send me further information on AMESTEAM GENERATORS and name of nearest representative.

NAME..

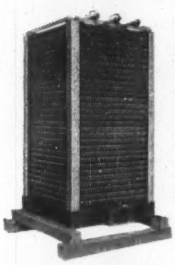
COMPANY..

ADDRESS..

AMES IRON WORKS INC.

BOX D-94 **OSWEGO, N. Y.**

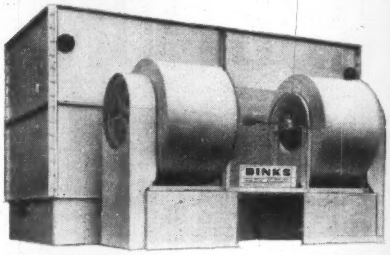
"PACKAGED" COOLING TOWERS—THE ANSWER TO LOW-COST OPERATION



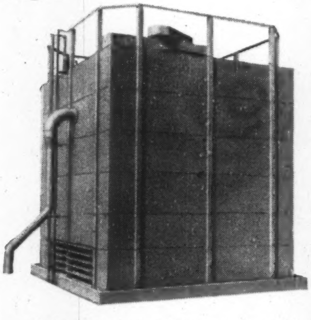
The growing use of cooling towers as a part of all air conditioning systems has made it possible to produce towers by mass production methods. These "packaged" units are superior in many ways to the former custom-made towers because they are better designed and thoroughly factory-tested under varying conditions.

Above: Binks Type "H" Series—widely used for refrigeration and air conditioning. Capacities range from 4 to 40 tons.

Below: Binks 3BB Series Multiple Blower Cooling Towers—Capacities range from 40 to 125 tons.

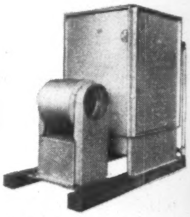


Packaged towers come in both natural and mechanical draft models...ranging from small, extra quiet towers for indoor use in residential air conditioning systems to larger towers capable of serving an entire building.

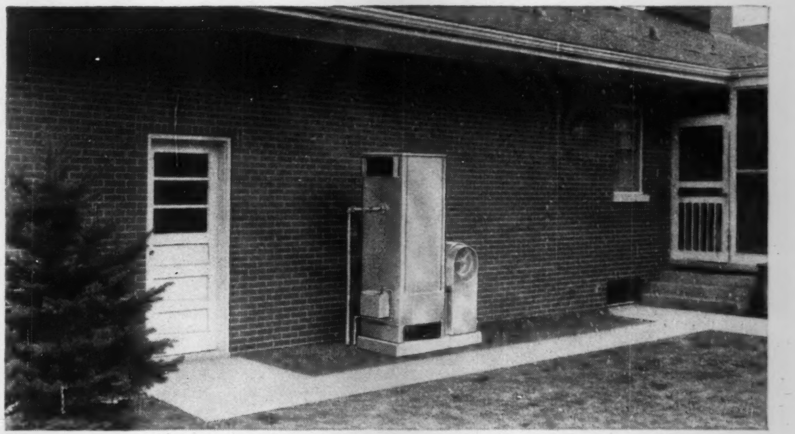


Above: Binks 2-K Series Induced Draft Cooling Towers. Capacities up to 800 tons.

Below: Binks 3-B Series Single Blower Cooling Towers. Capacities range from 5 to 36 tons.



One of the most complete lines on the market today is offered by the Binks Manufacturing Company, pioneers in this field. Binks engineers will help you select the right tower for any particular installation, upon receipt of information regarding local conditions, tonnage requirements, and cooling range required. 3118-38 Carroll Avenue, Chicago 12, Illinois.

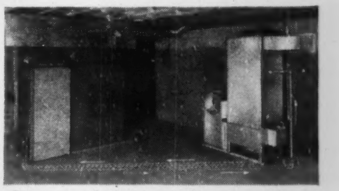


New Residence Cooling Tower Cuts Air-Conditioning Costs

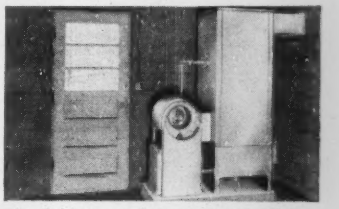
Saves 95% on cooling tower bills...today a cooling tower is a must in every air conditioning installation involving water cooled condensing units. Homes are no exception. In many communities the use of water for this purpose is restricted. In others high water rates result in excessive operating costs. A Binks Residence Cooling Tower makes it possible to cool and recirculate the condensing water...at a tremendous saving.

HERE'S WHY you will prefer Binks residential towers:

1. **Quiet operation!** Noiseless, squirrel-cage type blower supplies ample air movement at operating speeds far below the noisy propeller-type fans used in conventional cooling towers. All metal-to-metal connections are rubber cushioned. Interior surfaces are protected and soundproofed with heavy undercoating.
2. **Compact!** Fits into small space...in basement, garage, breezeway, out-doors.
3. **Easy to install!** Comes fully assembled ready for immediate water, electric and duct connections.
4. **Low maintenance!** All metal surfaces are heavily galvanized and given several coats of good paint. Construction is rigid. Nozzles are clog-proof. No moist air reaches the air propulsion mechanism.
5. **Efficient!** Binks' 25 years experience in the development and manufacture of successful commercial towers assures correct design and high efficiency for this residence tower.
6. **Attractively priced!** These towers are mass produced for economy.



Because of their noiseless operation, Binks cooling towers can be placed in utility or recreation rooms.



Available space in garage, carport or breezeway can be used.

Send today

for free Bulletins 47-B and 47-D which describe Binks Residence Cooling Towers in refrigeration capacities of 2 and 3 tons.

MAIL COUPON NOW

Binks

EVERYTHING FOR WATER COOLING

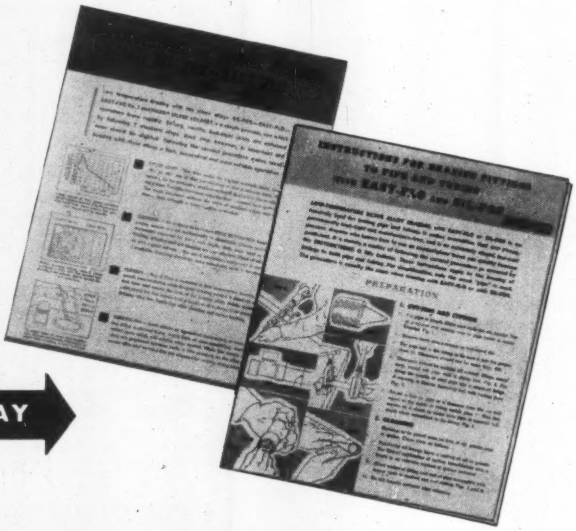
Binks Manufacturing Company
3118-38 Carroll Avenue, Chicago 12, Illinois
Gentlemen: Please rush FREE Cooling Tower Bulletins 47-D and 47-B and other facts including prices.
Name__________
Company__________
Address__________
City__________Zone_____State_____

PRACTICAL TORCH BRAZING INSTRUCTIONS

...in these two FREE bulletins

Here is useful information for anyone and everyone interested in knowing how to make strong, permanently leak-tight joints in ferrous and non-ferrous piping and tubing with the oxyacetylene torch.

- These two bulletins give complete step-by-step instructions for brazing fittings to pipe and tubing with the low-temperature silver brazing alloys EASY-FLO and SIL-FOS. They tell—how to cut and fit pipe and tubing—how to clean and flux surfaces to be joined—how to support assemblies for brazing—how to heat and apply the alloy. They cover the making of pipe and tubing joints in vertical up, vertical down and horizontal positions.



WRITE FOR YOUR COPIES TODAY

Ask for Bulletin 17 and the "Torch Brazing Instruction Bulletin."

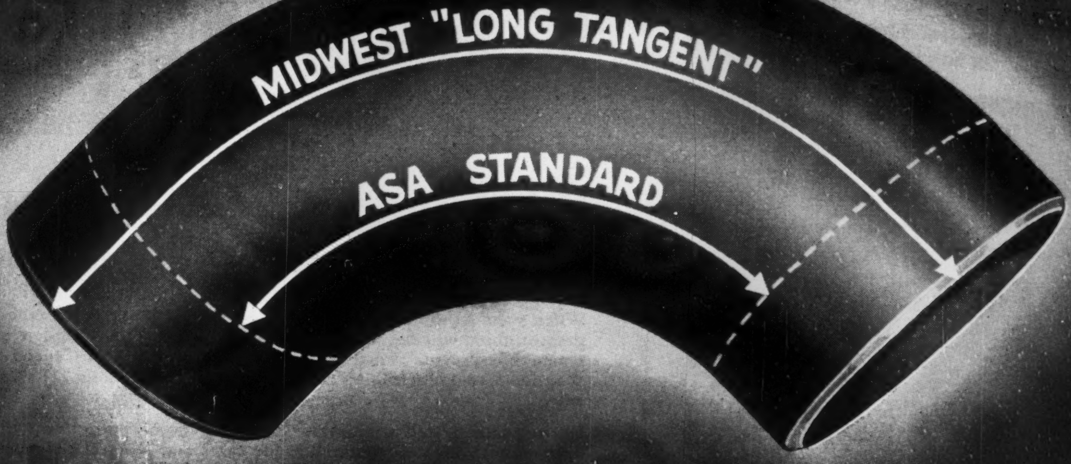
HANDY & HARMAN
FOUNDED 1867
QUALITY · SERVICE
ORIGINATORS OF EASY-FLO & SIL-FOS

HANDY & HARMAN

General Offices: 82 Fulton St., New York 38, N. Y.
DISTRIBUTORS IN PRINCIPAL CITIES

OFFICES and PLANTS
BRIDGEPORT, CONN.
PROVIDENCE, R. I.
CHICAGO, ILL.
CLEVELAND, OHIO
DETROIT, MICH.
LOS ANGELES, CALIF.
TORONTO, CANADA
MONTREAL, CANADA

When you buy welding elbows . . .



Why take less when you can get more?

. . . (and at the same price)

ADVANTAGES OF MIDWEST "LONG TANGENT" ELBOWS

- ★ They save pipe.
- ★ They often eliminate short nipples and their extra welds.
- ★ They save time and money in lining up and clamping pipe and fitting.
- ★ They make it easier to apply slip-on flanges.
- ★ They remove the circumferential weld from point of maximum stress and can be sleeved.
- ★ THEY COST NO MORE THAN OTHER ELBOWS.

As shown in the illustration above, Midwest "Long Tangent" welding Elbows have straight ends equal to ¼ of the nominal fitting diameter (a 12″ elbow has tangents 3″ long). For the reasons listed at the left, substantial savings are made on many piping systems by using Midwest "Long Tangent" Elbows. For more information about them, write for Catalog 54.

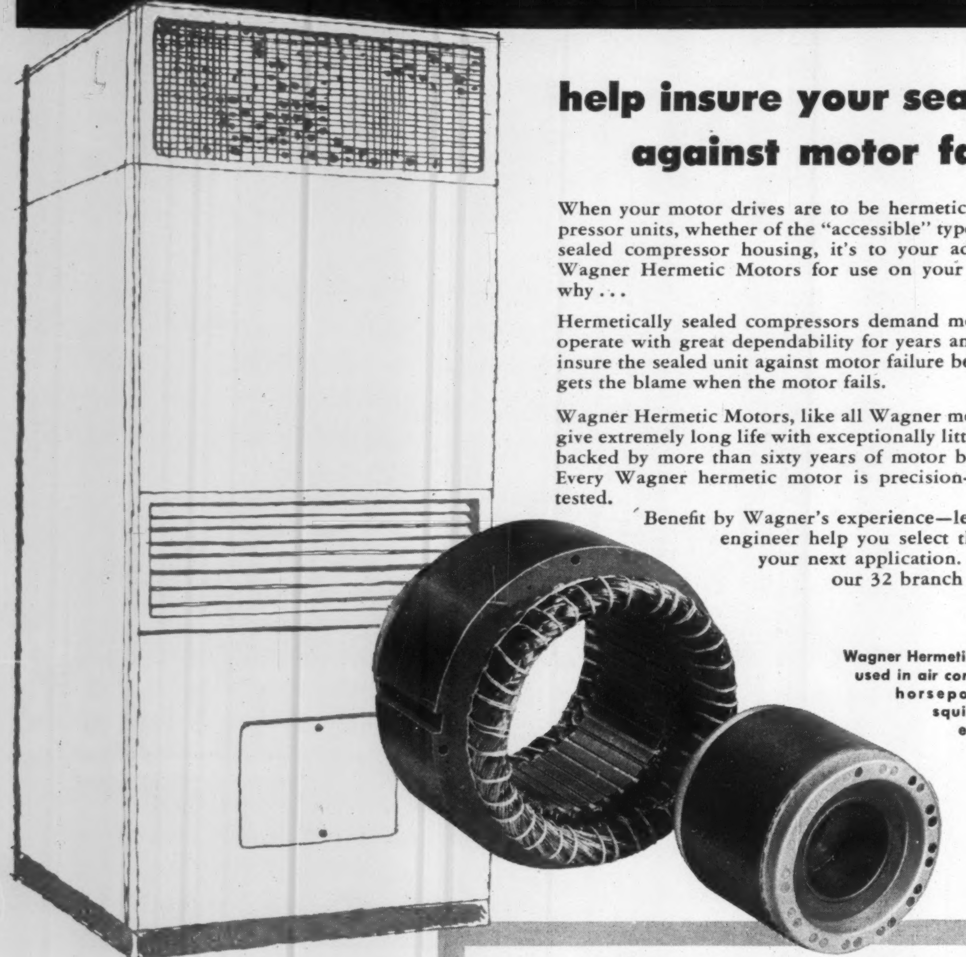
MIDWEST PIPING COMPANY, INC.
Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Passaic, Los Angeles and Boston
Sales Offices:
New York 7—50 Church St. • Chicago 3—79 West Monroe St.
Los Angeles 33—520 Anderson St. • Houston 2—1213 Capitol Ave.
Tulsa 3—224 Wright Bldg. • Boston 27—426 First St.
Cleveland 14 — 616 St. Clair Ave.
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

6722

MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS

Wagner®
ELECTRIC MOTORS
. . . the choice of leaders in industry

Wagner Hermetic Motors



help insure your sealed units against motor failure

When your motor drives are to be hermetically sealed in compressor units, whether of the "accessible" type or in a completely sealed compressor housing, it's to your advantage to specify Wagner Hermetic Motors for use on your equipment. Here's why . . .

Hermetically sealed compressors demand motor parts that will operate with great dependability for years and years. They must insure the sealed unit against motor failure because your product gets the blame when the motor fails.

Wagner Hermetic Motors, like all Wagner motors, are known to give extremely long life with exceptionally little trouble. They are backed by more than sixty years of motor building experience. Every Wagner hermetic motor is precision-built and carefully tested.

Benefit by Wagner's experience—let a skilled Wagner engineer help you select the motor drive for your next application. Call the nearest of our 32 branch offices, or write us.

Wagner Hermetic Motor of the type used in air conditioners. This 7½ horsepower polyphase squirrel-cage motor is especially designed for use in sealed refrigeration units.

Hermetically sealed compressors for air conditioners and refrigerating equipment are rapidly gaining preference because of the great convenience they offer to users of the equipment—there is nothing to oil or adjust, no belts to fail.

Standardize with Wagner:

Wagner Motors are the choice of many leading equipment manufacturers for several basic reasons:
First, Wagner Motors, for over sixty years, have established unexcelled records for continuous, trouble-free performance.
Second, Wagner Motors are well known for their superior quality and their sturdy design and construction.
Third, the many types of motors and motor modifications in the standard Wagner line help the design engineer in his selection of the right motor for the job.

Wagner Electric Corporation
EST. WE 1891

WAGNER ELECTRIC CORPORATION
6370 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

ELECTRIC MOTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

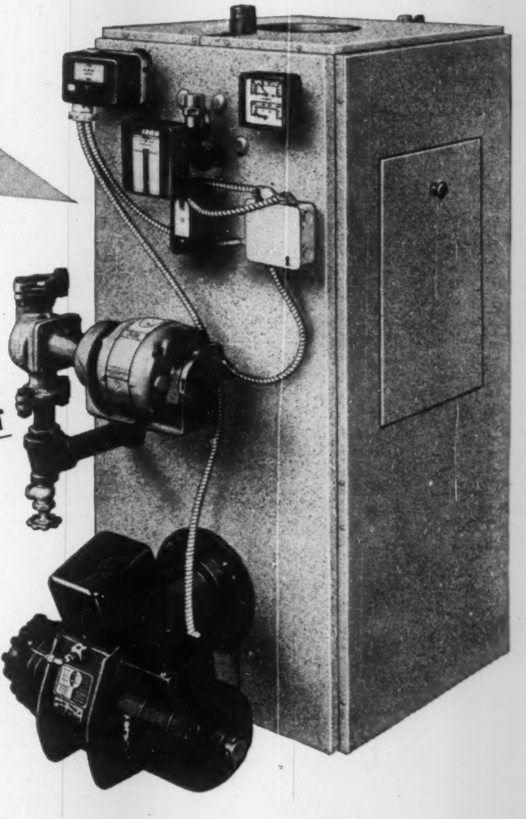
M54-2

here's
a new
"PACKAGED" boiler
your customers
will *REALLY GO FOR!*

CAST IRON FOR LONG LIFE!

THE ~new~ *Burnham* PACE-PAK

FACTORY ASSEMBLED OIL HEATING UNIT

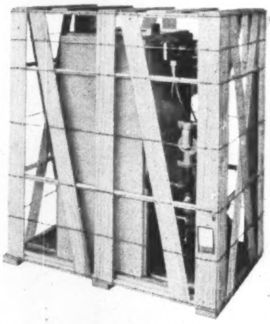


All equipment factory installed

FLUSH JACKET
OR
JACKET EXTENSION*
OIL BURNER
ESSENTIAL CONTROLS
FULLY APPROVED WIRING HARNESS
CIRCULATOR
TANKLESS HEATER

Delivered in one crate ready for easy installation and at a big saving in time and money.

*Shipped, when ordered, in separate carton



Here's how PACE-PAK is delivered to you. Heavy skid crate bottom makes handling easy. After crate is removed unit can be rolled into position on two sections of pipe.

Installation savings alone make this boiler a bargain! Burnham quality makes it doubly attractive.

Here's a new packaged oil heating unit that has everything you need to make profitable sales. It's cast iron. It's a fuel saver. It's an investment in lifetime comfort. It provides plenty of steaming hot water, the year 'round, for laundry, kitchen and bath . . . and at low cost! Its net IBR water rating is 530 sq. ft. Attractively styled jacket is handsome two-tone blue and silver gray Hammerloid baked enamel finish, heavily insulated to prevent heat loss. It comes factory assembled "ready to go" . . . at a big saving in installation time and money! This is what you've been waiting for. It's *your* answer to quality home heating at low cost! Mail the coupon today. Get all the facts about this money maker!

Burnham Corporation

FIRST IN THE MANUFACTURE
OF BASEBOARD HEATING

IRVINGTON • NEW YORK

Burnham
RADIANT HEATING
SINCE 1873

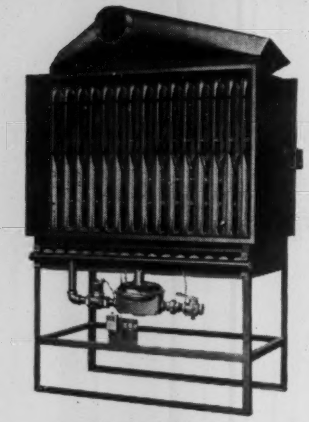
I.B.R
INSTITUTE OF BOILER AND RADIATOR MANUFACTURERS
MEMBER

HP-94

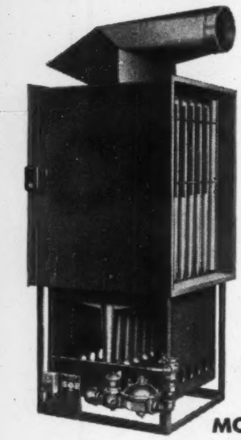
BURNHAM CORPORATION
IRVINGTON, NEW YORK

Please send your 4-page brochure on PACE-PAK with ratings and prices.

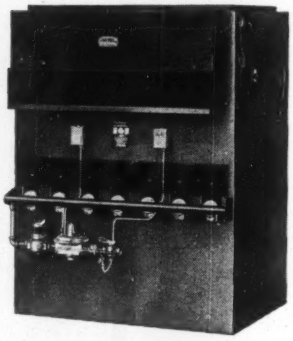
NAME...
ADDRESS...
CITY.........................STATE...................
....



MODEL SED-E



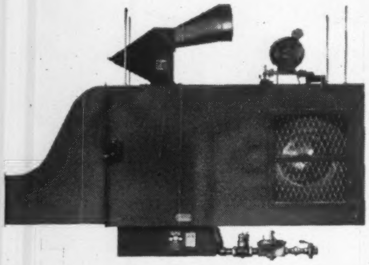
MODEL SED-S



MODEL SED-VF

MODEL SED-E — Non-corrosive type 321 stainless steel heat exchanger. Permits installation downstream of cooling equipment, for continuous blower operation. Air throughput in either direction. 80,000 to 600,000 Btu input.

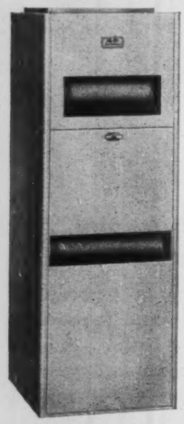
MODEL SED-S — Same as SED-E except controls are at the side, instead of at the end where accessibility requires either SED-E or SED-S is available in sizes from 80,000 to 600,000 Btu input in increments of 40,000 Btu.



MODEL SEU

MODEL SED-VF — Tested and approved as a duct furnace; type 321 stainless steel. Re-circulated or fresh air enters through bottom, sides, or back. Built in air bypass, vent in front. Sizes from 70,000 to 245,000 Btu input.

MODEL SEU — Suspended unit heater. Recirculates room air. Diffuser outlet with adjustable vertical and horizontal vanes. Double inlet forward curve blower. Continuous duty variable pitch drives, raised port burners.



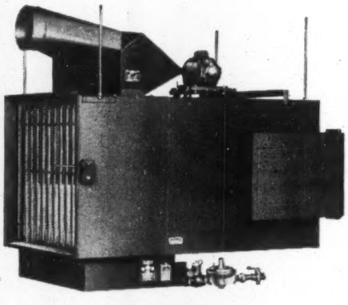
MODEL SEC

HAYES

FURNACES

outstanding for commercial, industrial, schools, churches, theaters, large residential

HAYES FURNACE MFG. & SUPPLY CO.
2929 So. Fairfax Ave., Los Angeles 16, California
Telephone TExas 0-3734



MODEL SES

MODEL SEC — Forced air furnace. Stainless steel heat exchanger sections seam and arc welded. One piece cast iron burners with drilled ports. Oversize double inlet blower glass or washable filters. 6 sizes — 70,000 to 245,000 Btu input.

REPRESENTATIVES

M. Blazer & Son, Passaic, New Jersey.
Blue Flame Supply Company, Atlanta, Georgia.
Eugene Bolstad, Edmonton, Alberta, Canada.
E. B. Bomar, Phoenix, Arizona.
Boyd Engineering Co., Albuquerque, New Mexico And El Paso, Texas.
Reube O. Emery, Nashville, Tennessee.
Hinkle Supply Company, Birmingham, Alabama.
Leudecke Engineering Co. Austin Texas
McCombs Supply Co., Denver, Colorado.
J. M. O'Connor Co., Wichita, Kansas.
O'Connor-Oklahoma Co., Oklahoma City and Tulsa, Oklahoma.
Smith Steam Specialty Co., Kansas City, Mo.
Tay-Holbrook, Inc., San Francisco, California.
F. R. Young, Houston, Texas.

MODEL SES—Forced air, suspended furnace for installation in suspended duct system. Inlet and outlet designed for sheet metal duct connection. Double inlet forward curved blower. Continuous duty variable pitch drives raised port burners.

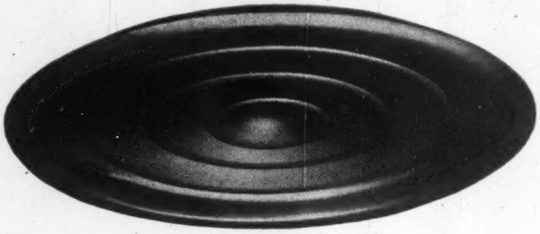
ANOTHER
AGITAIR
PATENTS APPLIED FOR

for BETTER AIR
it's ADJUSTABLE

AIR DEVICES INC., 185 MADISON AVE., NEW YORK 16, N. Y.

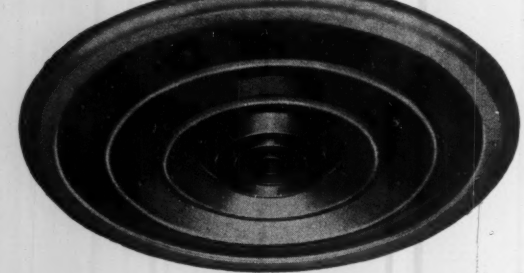
THE Aerofuse LINE

In appearance, Aerofuse Diffusers are styled to harmonize with contemporary architectural concepts . . . in performance, the flexibility of the line permits engineers to select a type and size that will operate with top efficiency . . . simplicity of design and rugged construction result in simplified installation. Good reasons why Aerofuse Diffusers have nation-wide acceptance by architects, engineers, contractors and owners, and are installed in the most modern multi-story office buildings and department stores, in commercial and recreational buildings, institutions and industrial plants . . . wherever people work or relax in air conditioned comfort.



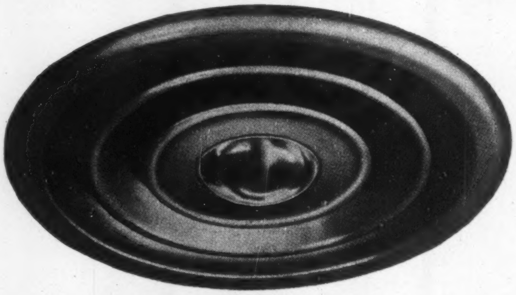
TYPE PA

Adjustable pattern diffuser



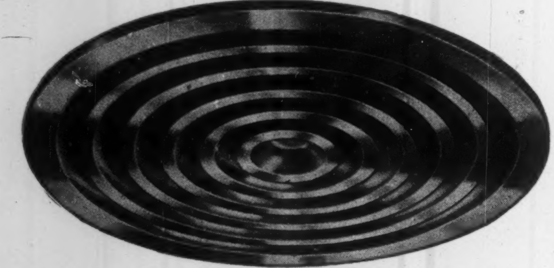
TYPE PR

Flush type, fixed pattern supply and return diffuser



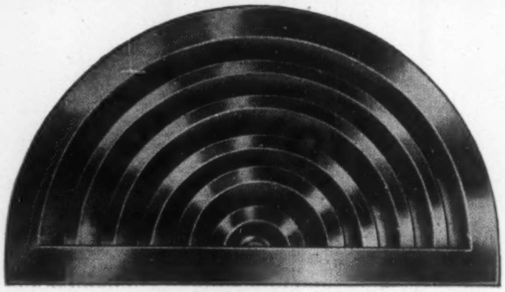
TYPE PLF

Flush type, fixed pattern diffuser combined with light fixture



TYPE S

Flush type, fixed pattern diffuser



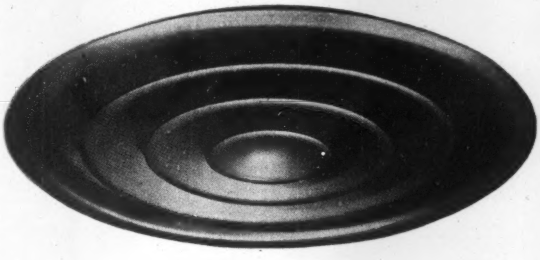
TYPE H

Flush type, fixed pattern half-round diffuser

Accessory Equipment

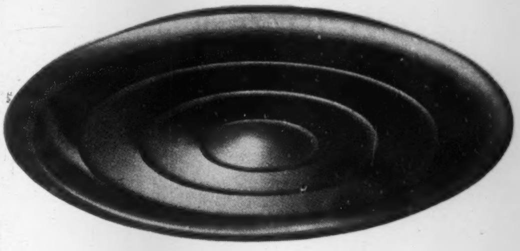
To meet specific air delivery requirements, volume control dampers, distributing grids, blanking baffles, and other accessory equipment is available for all Aerofuse Diffusers.

A wide selection of diffuser types and sizes, styled and engineered to meet the most rigid requirements of appearance and performance at the point of air delivery



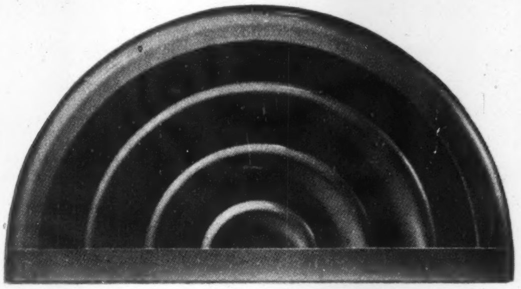
TYPE PS

Stepped-down type, fixed pattern diffuser



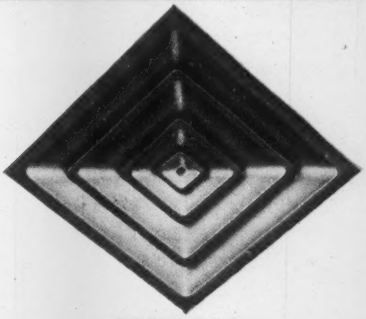
TYPE PF

Flush type, fixed pattern diffuser



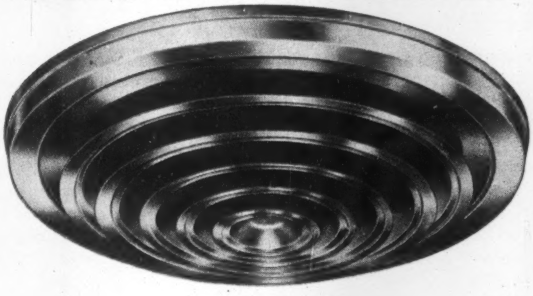
TYPE PH

Flush type, fixed pattern, half round diffuser



TYPE D

Flush type, fixed pattern square diffuser



TYPE ES

Stepped-down type, fixed pattern diffuser

TUTTLE & BAILEY inc

NEW BRITAIN, CONNECTICUT

NEW . . . Aerofuse Catalog No. 108.

Complete information on the Aerofuse line of ceiling diffusers and accessory equipment, engineering data, size selection charts and directions for installation. Send for your copy today.

Aerofuse
DIFFUSERS
TUTTLE & BAILEY

ZONE CONTROL of indoor climate REQUIRED . . .

PROVIDED economically with CHRYSLER AIRTEMP

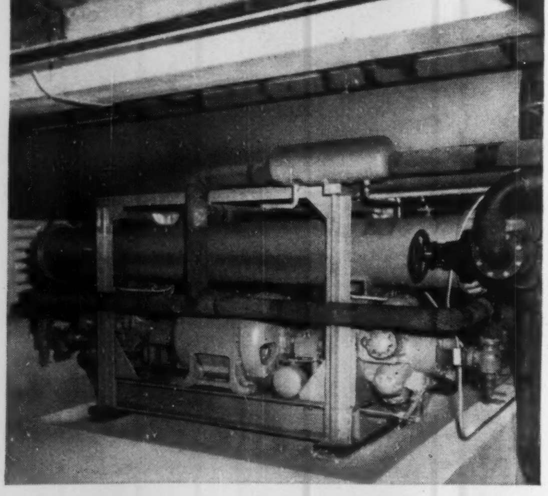
CENTRAL STATION AIR CONDITIONING

Engineers: Sasnett & Bennett, Miami;
Levy & O'Keef, New York City.
Gen. Contractor: Robert L. Turchin.
Mechanical Contractor:
Markowitz Bros., Inc.

Ainsley Building,
Miami, Florida.
Owner: Herman Greenfeld.
Architect: Morris Lapidus.

Professional and commercial offices of many types in the Ainsley Building in Miami made zone climate control on every floor a primary requisite in planning the year 'round air conditioning. And economy of installation and operation dictated a central station system. So the air conditioning was engineered to fit! Chrysler Airtemp central station equipment supplies chilled water for cooling and warm water for heating to air handling units. Every zone on every floor has individual control.

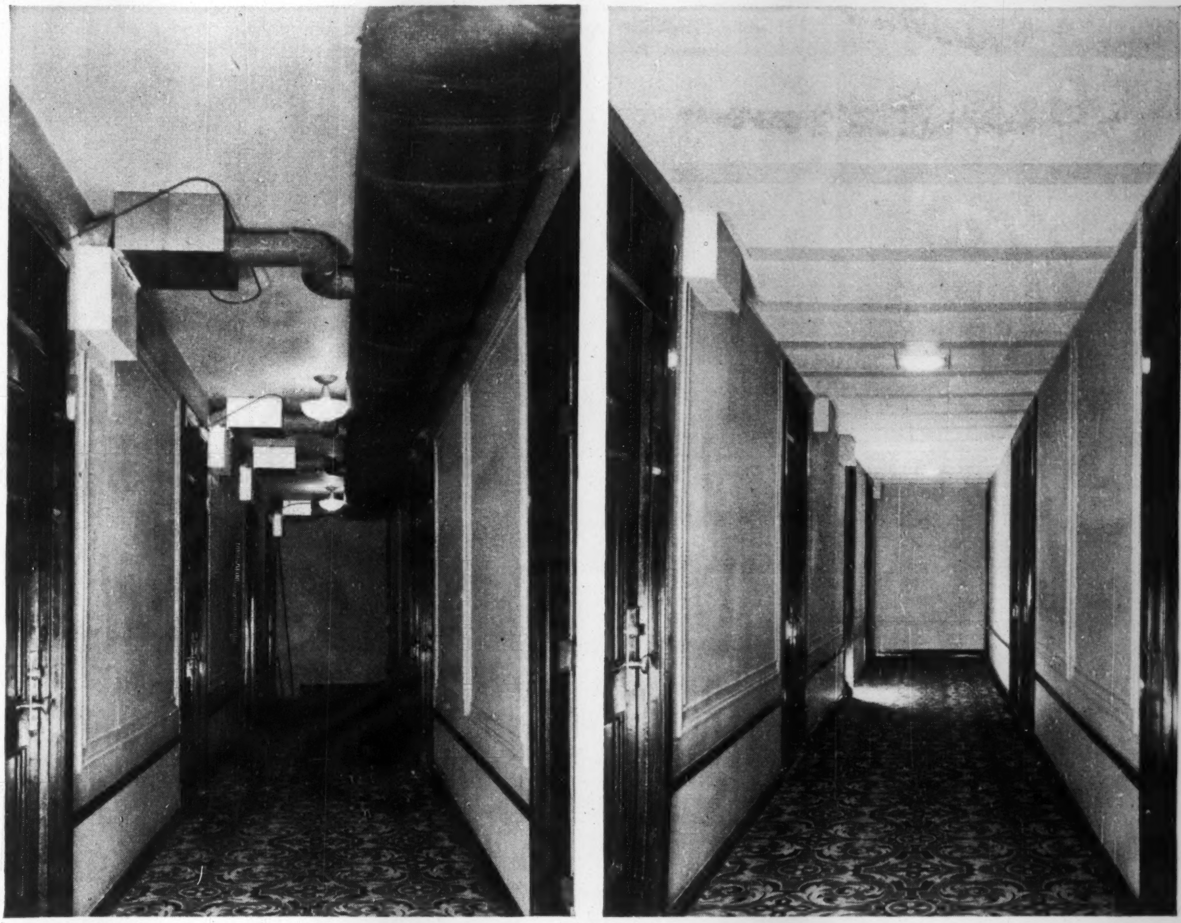
Whether the particular requirements of a building make one system or a specially-engineered combination of air conditioning systems the most practical choice, Chrysler Airtemp has the answer. A complete line of equipment for *every* air conditioning need is produced in Chrysler Airtemp's windowless, air conditioned plant. And through a wholly-owned subsidiary, Airtemp Construction Corporation, architects, engineers and contractors get a complete air conditioning service. Just write to Airtemp Division, Chrysler Corporation, Dept. HP, 1600 Webster Street, Dayton 1, Ohio.



Four 125 H.P. Chrysler Airtemp "Packaged" Liquid Chillers supply chilled water for cooling which is pumped to air handling units on each floor. Chrysler Airtemp Variable-Capacity Radial Compressors feature exclusive weight-saving, space-saving design. Perfect balance reduces noise and vibration—no special foundations required!

CHRYSLER AIRTEMP

HEATING • AIR CONDITIONING for HOMES, BUSINESS, INDUSTRY
AIRTEMP DIVISION, CHRYSLER CORPORATION
Dayton 1, Ohio



MINIMUM REMODELING needed to air condition this 400-room hotel. False ceiling (picture, right) hides small air ducts and high pressure units used in...

Kno-draft High Pressure System

Famous Lincoln Hotel, in Indianapolis, wanted to air condition its rooms. Separate refrigeration units for each floor had to be ruled out. So did individual window units. And space limitations prevented use of the regular sized ducts used for ordinary low-pressure air distribution.

A High Pressure System, designed by Bevington, Taggart and Fowler, consulting engineers, solved the problem. In this system, air is circulated through small ducts at better than 3,000 feet per minute and at 16 times normal pressure. In the take-offs to each room, however, specially designed Kno-Draft high pressure units assure quiet air delivery.

Another Kno-Draft advantage: the amount of air to each room can be varied from *within the room* by a simple wall control.

Does the foregoing spark an idea for one of your present jobs? Connor engineers will gladly help you in any way they can. As a first step, clip and mail the coupon below to Connor Engineering Corporation, Danbury, Connecticut.

CONNOR

see our catalog in
ARCHITECTURAL FILE
or write for copy

kno·draft®

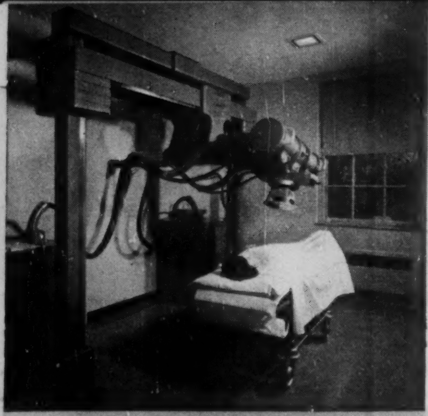
adjustable air diffusers

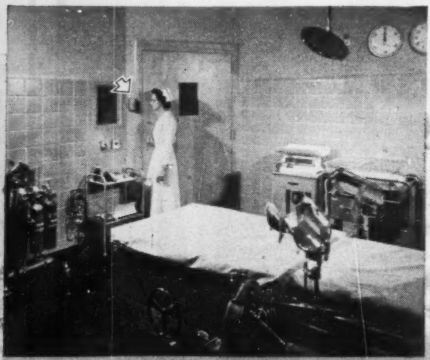
CONNOR ENGINEERING CORPORATION
Dept. G-94, Danbury, Connecticut

Please send full information on High Pressure Systems and Kno-Draft High Pressure Diffusers.

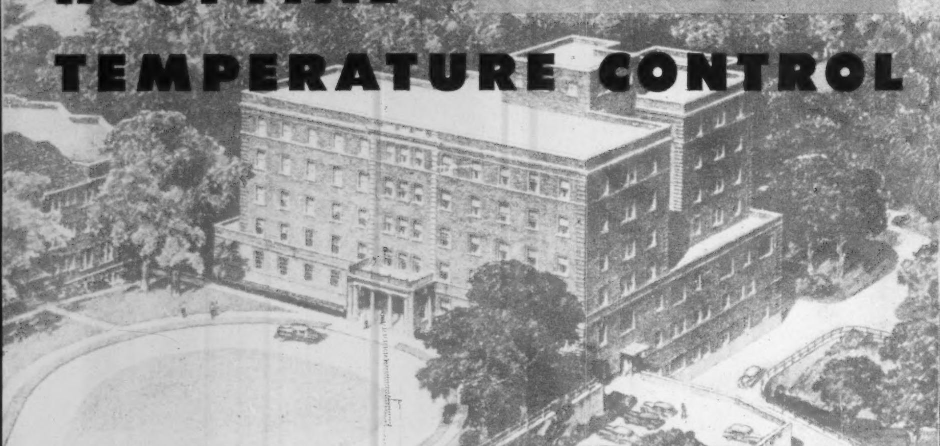
Name ____________________
Company ____________________
Address ____________________
City ____________ **Zone** ______
State ____________________

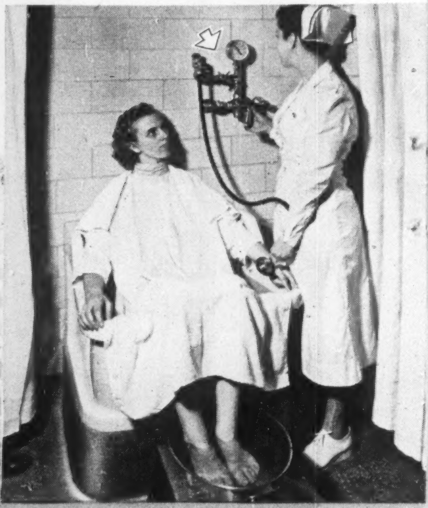
Architects and Engineers: **Fugard, Burt, Wilkinson and Orth** • **Edward G. Halstead**
General Contractor: **E. H. Marhoefer Jr. Co.**
Contractors: **Thomas J. Douglass & Co.** (Heating) • **Charles E. Gazin** (Plumbing)
Plumbing Wholesaler: **American Radiator Standard Sanitary Co.**
All of Chicago, Ill.


Deep Therapy X-Ray Room

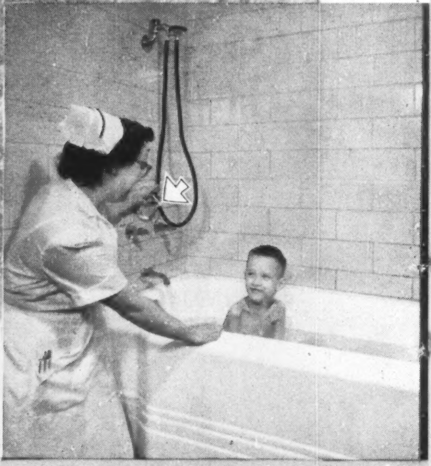

Air-Conditioned Delivery Room

HOSPITAL TEMPERATURE CONTROL

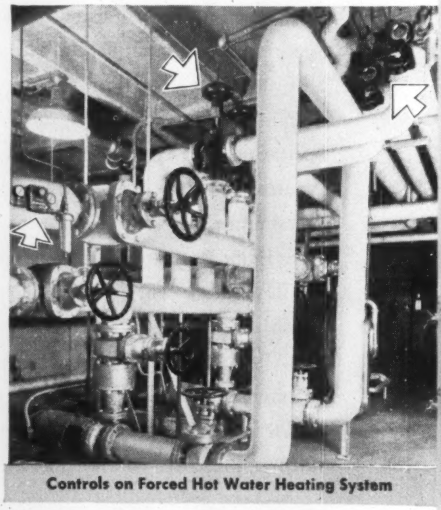



Powers Control on Sitz Bath with Raised Base

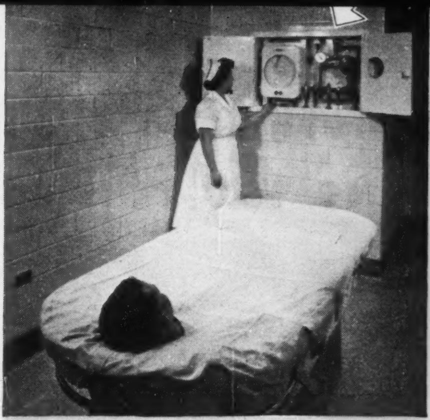
Section of Nursery

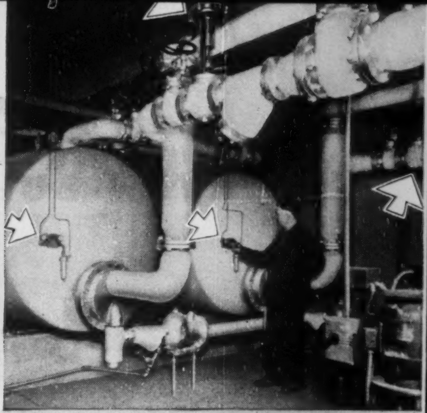

Treatment Bath for Children. Note Powers Mixer

Powers Controlled Whirlpool Bath for Polio Patients


Controls on Forced Hot Water Heating System

Powers Thermostatically Regulated Showers


Continuous Flow Bath—Note Powers Control Cabinet


Large Water Heaters—Powers Controlled

HINSDALE, ILL. SANITARIUM AND SHOWS DIVERSITY OF POWERS

★ FOR HEATING ★ AIR CONDITIONING ★ WATER HEATERS ★ HYDRO-THERAPY ★ SHOWER BATHS

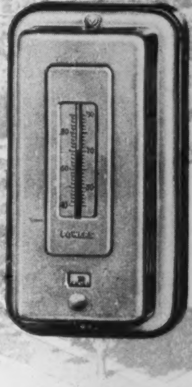
Few 200 bed institutions are as well equipped to save and prolong lives as Hinsdale's Sanitarium and Hospital

It's six operating rooms, X-Ray department (including a 250,000 volt deep-therapy machine for cancer treatment), delivery rooms, beautiful nursery and obstetrical department are all equipped with the best modern equipment.

Outstanding Polio Treatment Center. Facilities here can accommodate up to 30 polio patients and keep them in complete isolation. Three iron lungs, rocking beds, steam rooms and many types of hydro-therapeutic baths under the care of skilled attendants provide patients with the best service obtainable.

Comfort and Safety of Patients here is assured by the dependability of Powers thermostatic controls used throughout the building.

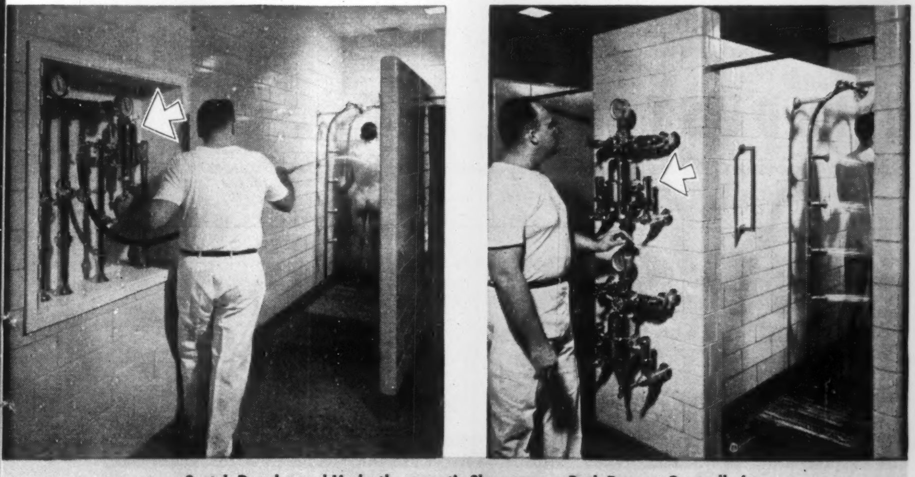
When you want help in selecting the right type of control for hospitals or any other type of building, call in an experienced Powers engineer. There's no obligation. (b86)



THE POWERS REGULATOR COMPANY

SKOKIE, ILL. • Offices in Over 50 Cities in U. S. A., Canada and Mexico

OVER 60 YEARS OF AUTOMATIC TEMPERATURE CONTROL

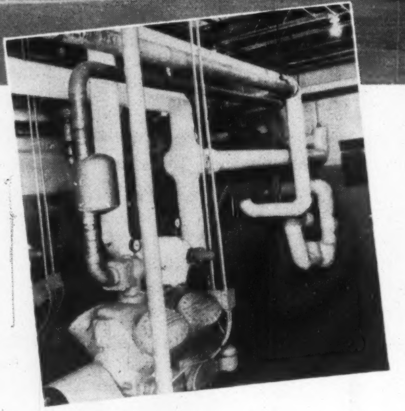

Scotch Douche and Hydrotherapeutic Showers are Both Powers Controlled

One of Three Iron Lungs in Children's Room

Steam Rooms Regulated by Powers Thermostats

Acme furnished the package for RYAN BUILDING 100-TON COOLING SYSTEM

CONTRACTOR — Art Calvert Sales & Service
CONSULTING ENGINEER — R. L. Duffer



When the Florida Power & Light Company decided to air condition its Ryan Building offices in Miami, Florida they took the easy way of installing a system by using an Acme Flow-Therm Packaged Water Chiller. This unit consisting of a two-circuit Acme Dry-Ex, two Acme HX Heat Exchangers, and two Acme STF Condensers furnishes 300 GPM of 46° water to the system. It is used in conjunction with two 50 HP Carrier Compressors.

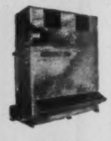
Buying a "package" gave the company a perfectly balanced unit, greatly reduced their installation time and expense, saved space, and, being an Acme Flow-Therm, enabled them to select a packaged unit specifically tailored to their job requirements.

The Flow-Therm is the latest addition to the Acme line of air conditioning and refrigeration products. It is the answer to the contractor and user who wants the benefits of a packaged unit along with the chance to specify matching Acme components. It can be used with any model or make compressor. See your Acme representative for more information on the Flexible Flow-Therm.

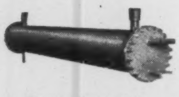
ACME INDUSTRIES, INC.

Mfgs. of a complete line of Air Conditioning and Refrigeration Equipment

JACKSON, MICHIGAN

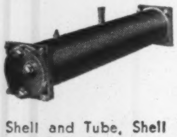


Evaporative Condensers
Cooling Towers
Floor-type Unit Coolers



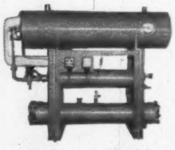
Direct Expansion (Dry-Ex) and Flooded Liquid Chillers

Heat Exchangers, Oil Separators

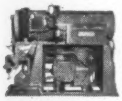


Shell and Tube, Shell and Coil Condensers

Receivers, Pipe Coils

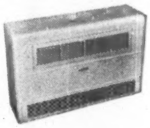


Packaged Liquid Chillers to 225 tons



Flow-Temp Heat Pumps

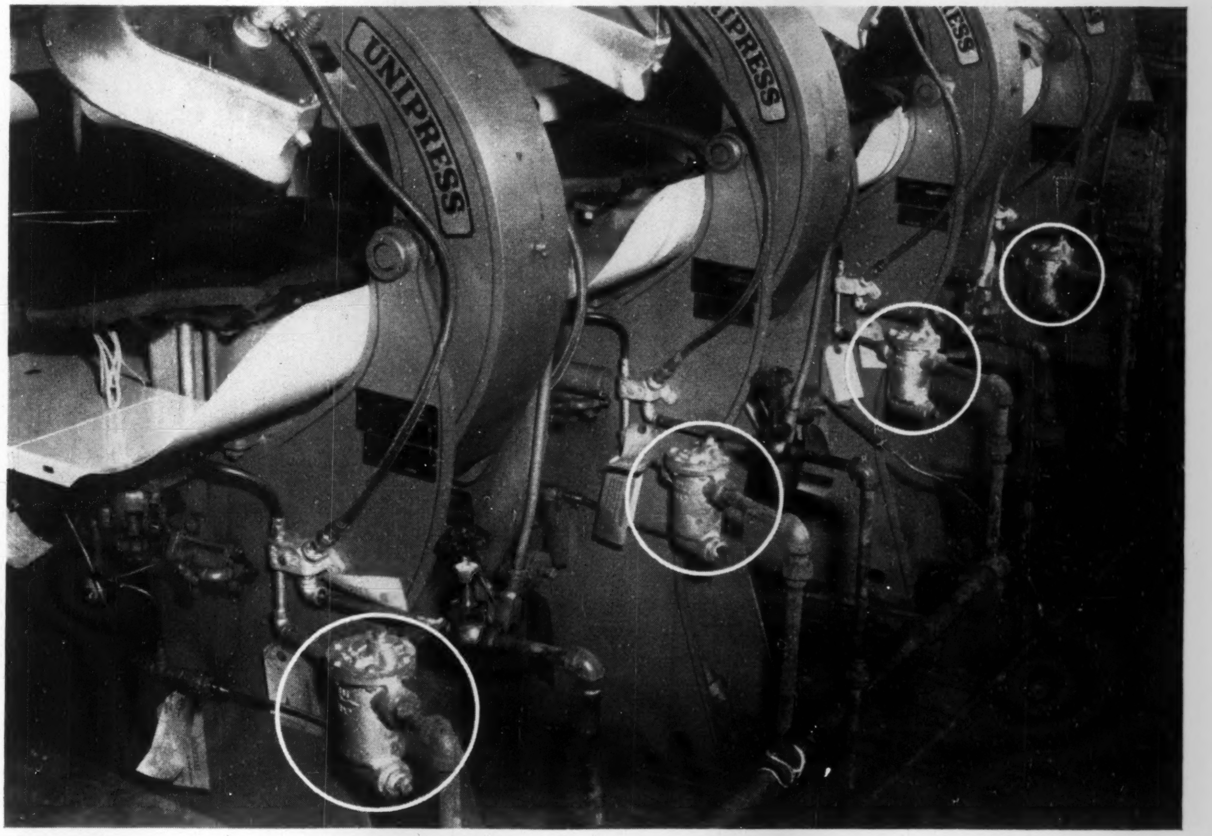
Flow-Cold Liquid Chillers



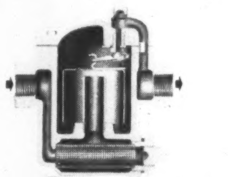
Remote Room Conditioner

Continuously serving the air conditioning and refrigeration industry since 1919

You can't save money by skimping on Steam Traps—
An Armstrong Trap *on every unit* always pays dividends



Plant doubles production without appreciable increase in fuel costs



STRAINER BUILT IN

Built-in Strainer Traps save fittings, labor, maintenance. Cost less than separate trap and strainer. Complete data in literature mentioned below.

When Standard Coat, Apron & Linen Service took over a previous linen service plant in Portland, Maine, the boilers could hardly handle the steam load. Mr. Tom Foley, General Mgr. called Files Steam Specialty Company, Armstrong Trap Representative in New England, to help correct the condition.

Under supervision of Mr. Ken Raymond, Chief Engineer, Armstrong traps were installed on *each* unit in the plant.

Results: doubled production with no appreciable increase in fuel consumption; higher machine temperatures; boilers easily handle the load.

This is a typical example of the efficiencies and economies possible through Armstrong unit trapping. Could your plant stand a shot in the arm? Call your Armstrong Representative, or write:

ARMSTRONG MACHINE WORKS
874 Maple Street, Three Rivers, Michigan

SEND FOR FREE CATALOG

—The "Steam Trap Book" contains 44 pages of trap data—selection, maintenance, trouble-shooting. Free on request. Or Consult Sweets or CEC.

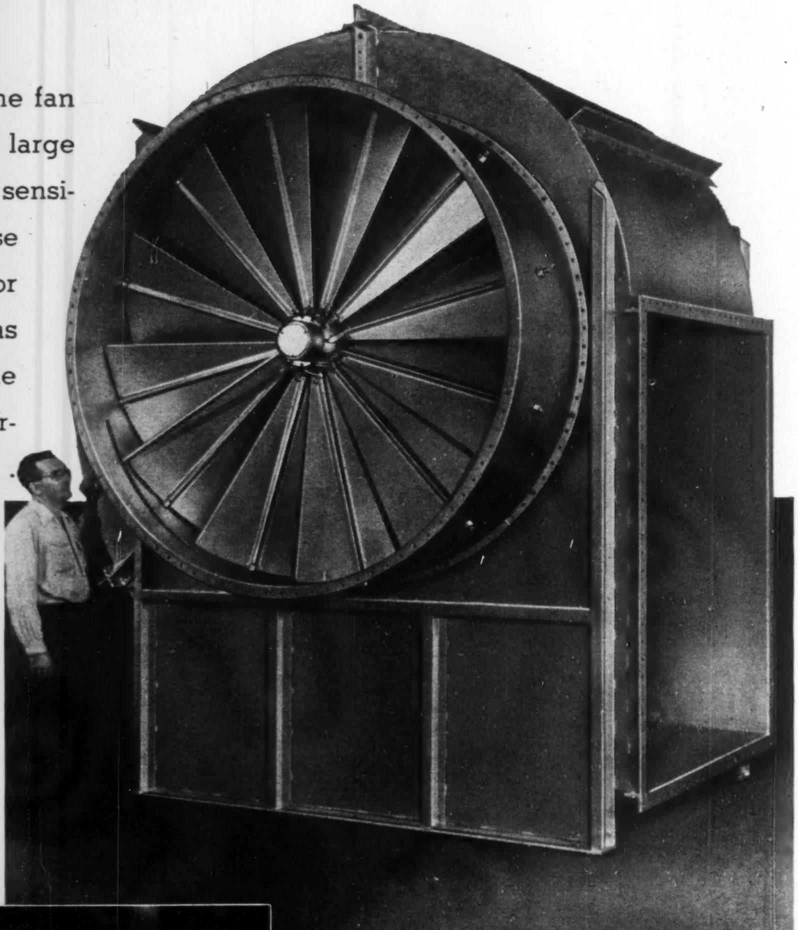
ARMSTRONG STEAM TRAP BOOK

ARMSTRONG STEAM TRAPS

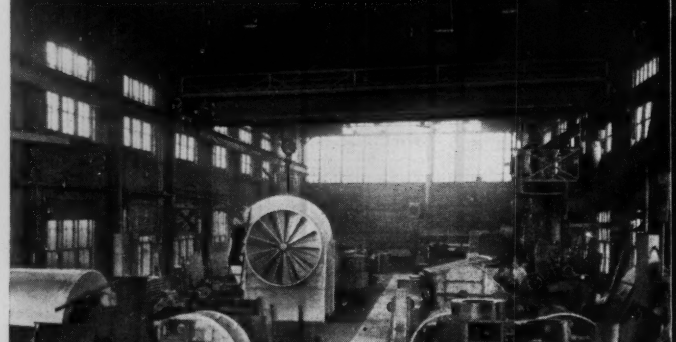
For PRECISION CONTROLLED FAN Performance...

. . . perfect co-ordination of the fan operation is essential. In this large vane-controlled unit, high sensitivity is the key to both ease and dependability in manual or automatic control. It serves as a typical example of the wide scope of BAYLEY fan engineering and construction skill . . . Facilities that can be effectively applied to *your* air handling problems.

●



No. 807 Aeroplex Kiln Fan
With Inlet Vane Control —
125,000 CFM — 7" S.P.



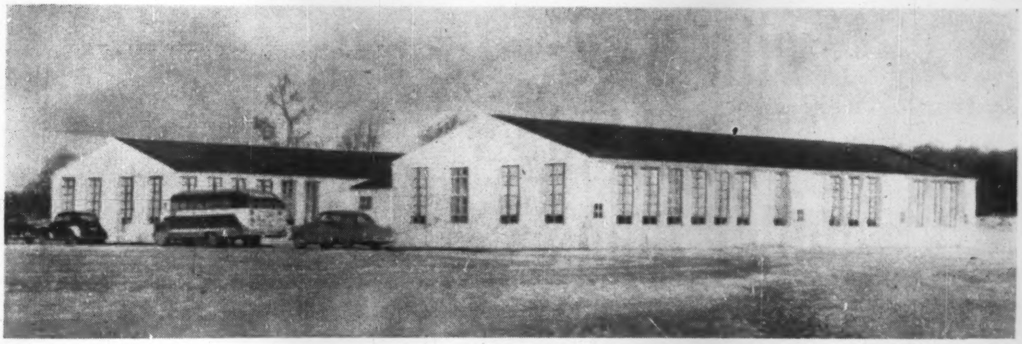
Bayley

BLOWER COMPANY

6600 W. Burnham Street • Milwaukee 14, Wis.

WARM AIR HEATED...

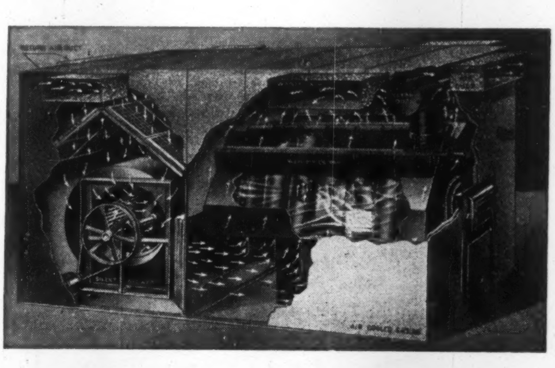
by Campbell



Public School, DeWitt, Michigan, heated with a No. 8125 Campbell oil-fired unit. Clark, Johnson and Anderson, architects, Pontiac, Mich. C. G. Brenner, Lansing, Mich., heating contractor.

PRACTICAL FOR SCHOOLS

For easy installation, exceptional fuel economy and long, dependable service, specify Campbell 8000 Series Heaters for schools and other large multi-room structures. These efficient Campbell Heaters make full use of the natural advantages of warm air heating; fast heat delivery, positive control of temperature and ventilation; plus quiet operation and exceptional fuel economy. Available for all fuels in capacities up to 3,000,000 BTUs.



MANUFACTURERS' AGENTS

We have a number of attractive openings for manufacturers' agents who call on heating contractors and architects. If interested, please state territory you cover.

CAMPBELL HEATING CO.
Des Moines 17, Iowa
I am interested in your proposition for manufacturers' agents.

My territory covers ....
NAME ....
ADDRESS ....
CITY .... ZONE ...... STATE ......

CAMPBELL HEATING COMPANY

Des Moines 17, Iowa

you get

Tight Joints

with B&W welded boiler tubes

2X120X3'0''TYPE
ASTM A-178-51T B
A OHS 15
B&W TUBES ERW
87483

A combination of qualities are offered by B&W Electric Resistance Welded Boiler Tubes that add up to savings in time, money and labor. The surfaces are free from pits, indentations, mill scratches and similar imperfections. Because of controlled normalizing practice, the surface is protected against formation of detrimental scale. This freedom from detrimental scale combined with uniform size and mechanical properties guarantees ease of "rolling in" and produces the tightest possible joint.

For three-quarters of a century, B&W has been directly concerned with developing and applying boiler tubes for all pressures up to those approaching 3000 psi. The application of this extensive knowledge and experience results naturally in the production of finer welded boiler tubes.

If you want ease of fabrication and long service life for the tubing in your boiler—specify B&W ERW Boiler Tubes.

LOOK FOR THIS

—wherever fine boilers are operating efficiently over extended periods. To meet the specifications of time; say B&W before you say WELDED BOILER TUBES—for service-proved dependability.

TA-4028(CWP)

B&W SEAMLESS and WELDED TUBES

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing

THE EDITORS' PAGES

• *A PERSONALITY STUDY of 514 scientific and technical staff members at a technical and research school revealed that successful scientists are not the timid souls content to stay confined to their laboratories as so often stereotyped. Instead, they are much the same as other individuals, having virtually the same range of interests and traits, it was reported in the study. Of the group studied, 70 percent were engineers and 30 percent were in the other physical sciences, with the average age being 32. The researchers found that the most creative workers held more degrees, belonged to more honorary and professional societies, and read more scientific journals.*

Construction Contracts Continue to Increase

. . . indicating present trend

CONTRACT AWARDS for future construction in the 37 eastern states continued to exceed previous records when the July and seven month totals of contracts for future construction were announced recently by the F. W. Dodge Corp.

The July total of $1,836,935,000 for contracts in the 37 states set a new July high in the 63 year history of the Dodge Corp. It was up 2 percent over July 1953 and 6 percent above June of 1954.

Thomas S. Holden, vice chairman of the Dodge Corp., commented: "The narrow lead margin of July 1954 over July 1953 was not surprising, considering the fact that July of last year had an unusually large contract volume. In fact, the margin of lead over last year may diminish further in the coming months, since the last half of 1953 showed the highest contract volume of any half year period yet recorded. It was even larger than the record breaking first half of 1954."

Also, an all time new high for the first seven months of any year was set with a total of $11,088,084,000, up 14 percent above the first seven months of 1953, and also above the previous seven month high set in 1951, which included $980 million in Atomic Energy Commission projects alone. Seven month categories compared with the same period in 1953 were: nonresidential, $4,049,522,000, up 9 percent; heavy engineering $2,312,431,000, up 12 percent.

July categories were: nonresidential, $641,513,000, down 2 percent from June and 16 percent below July 1953 and heavy engineering, $449,982,000, up 26 percent over June and 20 percent above July 1953.

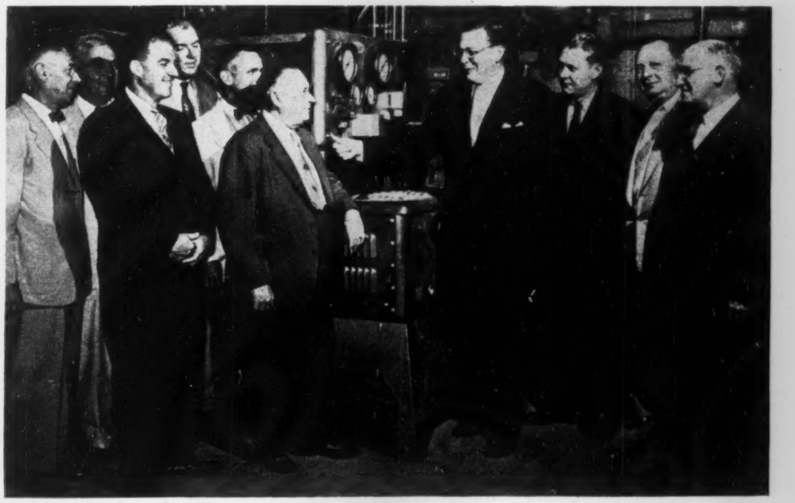
1954 Air Conditioning Installations Reported

. . . future looks bright

AIR CONDITIONING installations completed during the month of July 1954, as reported by the Union Electric Co. of St. Louis in its territory, indicate that of 77 installations 7 were 7½ hp, 34 were 5 hp, 21 were 3 hp, one was 10 hp, 11 were 2 hp, 2 were 15 hp, and one was 25 hp. These values are based on 12 contractors who reported on their installations. The installations do not include those made with room air conditioners. The total air conditioning load for other than room air conditioners that was connected to

New Air Conditioning System Started

. . . in existing office building



PUSHING THE BUTTON to start the operation of the newly installed 2500 ton air conditioning system in the Fidelity-Philadelphia Trust building is Howard Petersen, president of the building. Charles S. Leopold, consulting engineer and a member of HPAC's board of consulting and contributing editors is at the far right.

RECENTLY COMPLETED is the air conditioning of the 29 story Fidelity-Philadelphia Trust Co. building, which was erected in 1928. The building is "H" shaped and has over 600,00 sq ft of rentable area.

The system consists of the conventional bypass interior zone and high pressure perimeter units, and it occupies only one third of one percent of the rentable area. Installation was started in October 1953, and the plant was placed in operation on July 1, 1954.

the Union Electric system in July 1954 was 6100 kw. The total load connected since January 1, 1954—which includes room air conditioners—is 23,000 kw.

Room air conditioners that were installed by 26 distributors during the month of July 1954 were 6280. Of this total, 4129 were ¾ hp, 1851 were 1 hp, 224 were ½ hp, 34 were 1/3 hp and 42 were 1½ hp. The grand total of room units installed for the year as of the end of July is 16,970. Of this total, 11,715 are ¾ hp, 3752 are 1 hp, 1158 are ½ hp, 235 are 1/3 hp and 110 are 1½ hp.

Air Conditioning Sales Up 71 Percent

. . . over last year's record

AIR CONDITIONING sales were up 71 percent over the record first half of 1953 for one company, as reported by F. J. Van Poppelen, general manager, General Electric Co.'s Air Conditioning Div. This increase made this year the best first half on record.

Announcing the increase, Mr. Van Poppelen said, "The basic vitality of the air conditioning industry was well demonstrated by generally increased sales throughout the industry in the face of an unseasonably cool spring and late summer. We have found that the growing acceptance of air conditioning can easily override seasonal factors. When this acceptance is coupled with a high rate of building activity, as it has been this year, we find that the combination is unbeatable."

He predicted that his division's sales for the entire year would be substantially higher than those of 1953. He said an important contributing factor will be G.E.'s new air-cooled cooling unit recently introduced. "Because this product is the key to air conditioning in the critical water shortage areas found in many parts of the country," Mr. Van Poppelen said, "a heavy backlog of orders is already on our books. These orders will be reflected in second half shipments."

"Quote"

"Air conditioning plays a big part in your life even though you've never lived in a climate controlled apartment, worked in an air conditioned office or attended an air cooled movie theater. The scope of air conditioning application and utilization extends all the way from the manufacture of delicately constructed appliances, which must give accurate performance, to the operation of mining precious metals."—*M. M. Lawler, general manager and vice president of the Air Conditioning and Refrigeration Div., Worthington Corp.*

Building Construction Supports Steel Demand

. . . 1954 to be record year

A CONTINUING strong demand for steel products by the construction industry will help to maintain steel output for some time to come, according to Eugene G. Grace, chairman of the Bethlehem Steel Corp.

"1954 promises to be a record or near record year in at least four categories of construction," said Mr. Grace. These categories are commercial building, nonresidential public building, bridges and highways.

"There is a backlog of needed construction in the nation which should maintain a strong demand for several years to come," he added. "By that time, it is reasonable to conclude that even greater demands will have been generated."

Industry Lags in Modernizing

. . . expenditures to rise

ABOUT $60 billion worth of capital equipment in U.S. industry is more than 10 years old, and within two decades the figure will climb to $200 billion, according to S. D. Maddock, president of C.I.T. Corp. He said these figures indicate a steady rising demand for machinery and equipment to replace and supplement industry's capital equipment.

Mr. Maddock said a study by the Machinery and Allied Products Institute showed current replacement expenditures in industry are $10.4 billion annually. This figure, the study showed, will increase to $15 billion by 1960 and to $26.7 billion by 1975, Mr. Maddock added.

"Expenditures for replacement of old equipment would exceed these estimates impressively," Mr. Maddock said, "if industry weeded out all the obsolete and outworn machinery being used."

Soft Water Week Initiated This Year

. . . September 12-18

NATIONAL Soft Water Week, being initiated this year, September 12-18, will mark the first time in our history that national attention is focused on the most patient, obedient and widely used of industrial and domestic servants: water, according to the Water Conditioning Research Council.

Roughly 85 percent of the U. S. has hard water. Using the term "grain," the measure of hardness per gal of water — soft water being that of zero or up to ½ grain — this is the average degree of water hardness for some of the states. Pennsylvania, 7 grains; New York, 6.3 grains; Kentucky, 8 grains; Illinois, 17 grains; Minnesota, 16.5 grains; Texas, 13 grains; South Dakota, 29.6 grains; and California, 9.7 grains.

These states, among many others, have hard water. . . . .what does this mean to their people?

That hard water is a scourge of many industrial operations will be attested to by the thousands of plant repair and maintenance men who must attack scaled boilers and clogged pipes. Ledgers will show the depredations of millions of dollars of these unnecessary costs, while those plant operators who do employ soft water are the most enthusiastic witnesses in its favor.

Water conditioning, changing of hard water to soft, involves merely the removal of the hardness elements, the calcium and magnesium compounds, by a mechanical water softener, and the substituting for them of sodium, a "non-hard" element. This is done in plants at the actual cost of a very few cents a day, considering the amounts of water used.

just pennies a year for maintenance

Six engineers reported average costs of less than one cent per year to maintain a Webster Radiator Trap in service. The average of 16 installations was only 2.8¢ per year.

Webster Radiator Trap installations customarily give from 15 to 30 years of satisfactory service. And a survey covering 16 installations and a total of 51,816 Webster Traps in service showed average length of service at that time to be 30.3 years.

Those Webster Traps are still giving efficient service. They continue to save fuel; prevent steam loss; hold steam within the radiators or steam-using equipment until it has given up all its useful heat. Year after year, Webster Traps provide continuous, complete, automatic discharge of air and water of condensation. Even under severe operating conditions, Webster Traps give extra years of trouble-free service.

Furthermore, when Webster Traps finally do show signs of wear, Webster Trap Attachments will bring them up to date quickly and inexpensively, re-using all serviceable parts.

Webster Traps are available in 1/2″, 3/4″ and 1″ sizes and in many body models. Choice of Diaphragm or Sylphon Bellows type.

Before your next trap purchase, get facts and figures from your Webster Representative. He can give you full details of Webster Radiator Traps, Radiator Valves, Float and Thermostatic Traps, Dirt Strainers and other equipment for steam heating or process steam applications.

Address Dept. HP-9
WARREN WEBSTER & CO.
Camden 5, N. J. Representatives in Principal Cities
In Canada, Darling Brothers, Limited, Montreal

-since 1888
Webster
Systems of
Steam Heating

Other Webster Heating Equipment for commercial and industrial use includes Webster Tru-Perimeter Heating with steam or forced hot water; Webster Convectors; Webster Moderator Systems of Steam Heating and continuous flow controls for hot water heating — both with outdoor thermostat; and Unit Heaters. Data on request.

Webster Heating experience includes the field of vacuum, vapor and low pressure steam heating of buildings . . . medium pressure steam in industrial and process heating applications . . . and hot water heating systems for all types of building. Webster's specialized experience is available to you through engineers at the Home Office and through Representatives in 65 cities across the nation.

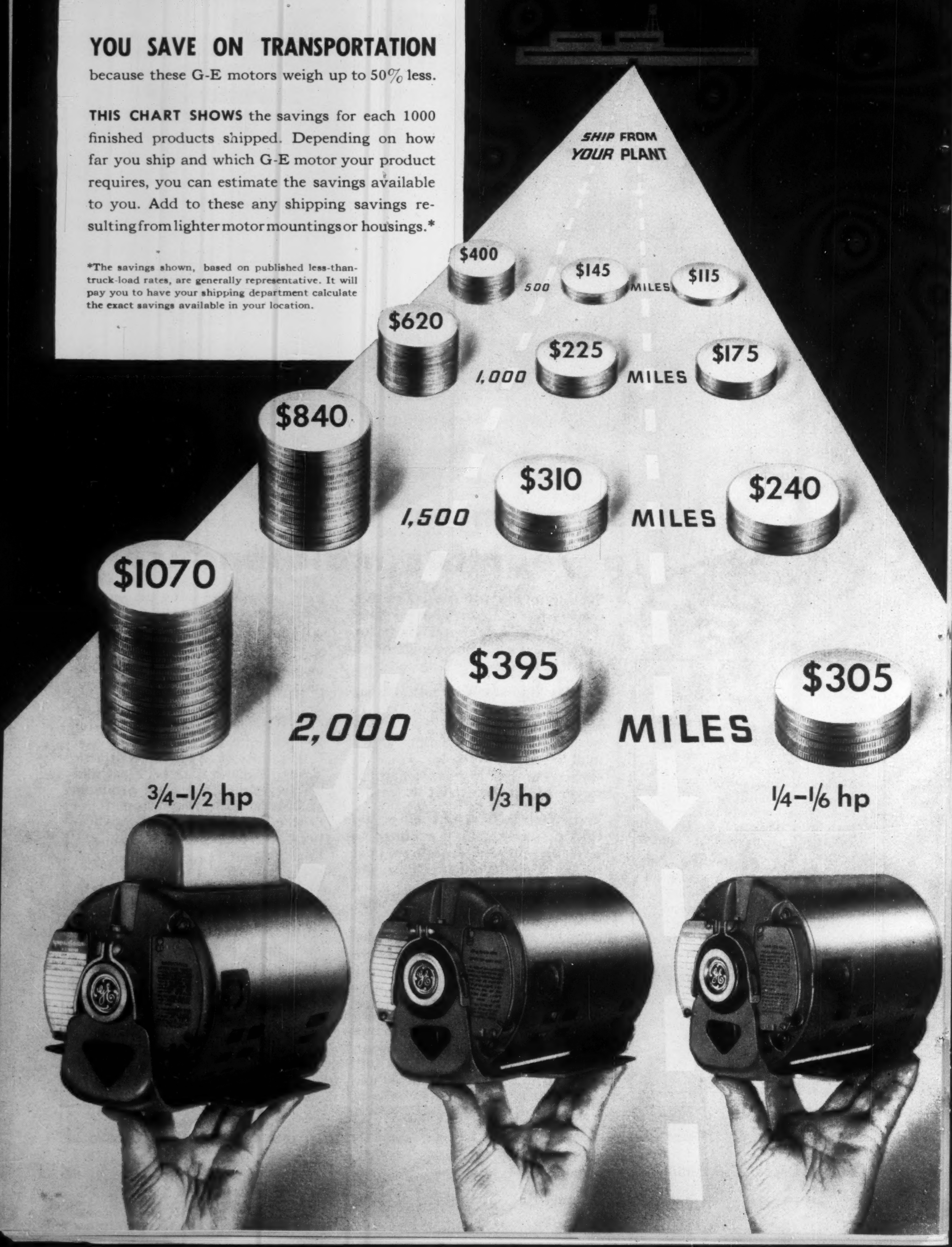
. . . not first cost but cost per year of service

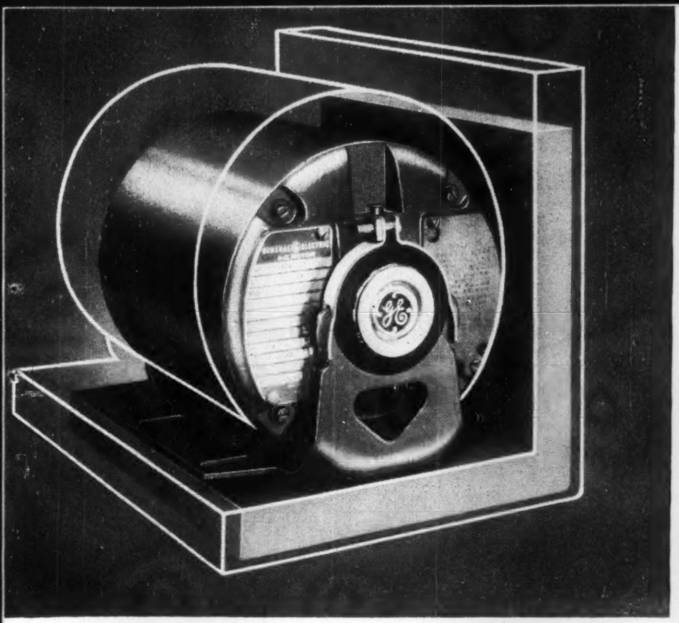
YOU SAVE ON TRANSPORTATION

because these G-E motors weigh up to 50% less.

THIS CHART SHOWS the savings for each 1000 finished products shipped. Depending on how far you ship and which G-E motor your product requires, you can estimate the savings available to you. Add to these any shipping savings resulting from lighter motor mountings or housings.*

*The savings shown, based on published less-than-truck-load rates, are generally representative. It will pay you to have your shipping department calculate the exact savings available in your location.





YOU SAVE ON MATERIAL COSTS because new G-E motors—as much as 50 percent lighter, 40 percent smaller—permit you to design smaller and lighter motor mountings and housings.

YOU SAVE ON ASSEMBLY COSTS because your assembly-line personnel will produce more efficiently with less fatigue since these General Electric motors are far easier to handle.

New smaller, lighter G-E motors give you 3 important cost savings

Significant savings are yours when you specify new lighter, smaller General Electric fractional-horsepower motors to power your products:

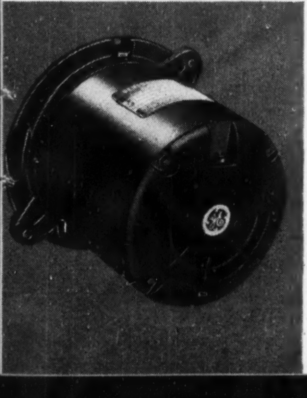
1. **YOU SAVE ON TRANSPORTATION**—New G-E motors, as much as 50% lighter, reduce your finished-product shipping costs.
2. **YOU SAVE ON MATERIALS**—Reduced motor weight permits use of lighter mountings. Smaller size (by 40%) means smaller housings are adequate.
3. **YOU SAVE ON ASSEMBLY**—Your assembly-line people will find the all-new G-E designs take the strain out of motor handling, speed installation.

You'll find these new G-E motors solve design problems, too: improved insulation and a new ventilation system permit application where adverse conditions exist . . . add to motor life in any location. A better lubrication system and thrust-bearing design mean that these new motors will operate at any angle.

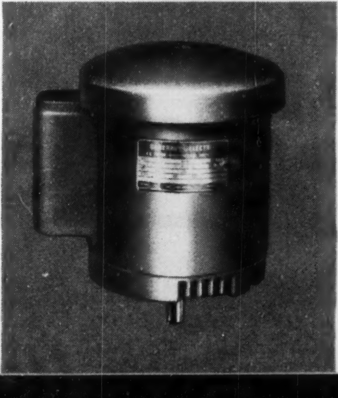
To start saving with these amazing new motors, contact your nearby G-E Apparatus Sales Office today. Or write for Bulletin GEA-5567 to General Electric Co., Section 702-10, Schenectady 5, New York.

GENERAL ELECTRIC

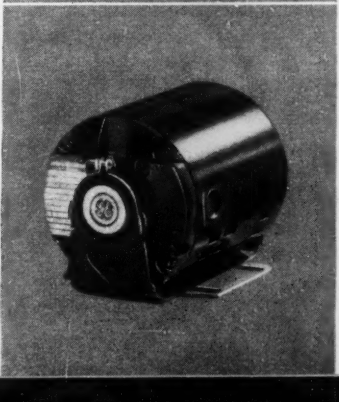
OIL BURNER MOTORS



JET PUMP MOTORS



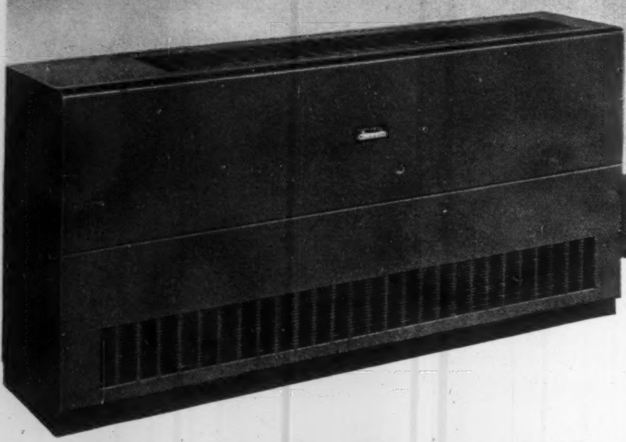
FAN MOTORS



LAWN MOWER MOTORS

WARREN WEBSTER & CO.

Announces a New WEBSTER-NESBITT Series C Unit Heater *that has everything!*



A deluxe line of cabinet heaters in five basic sizes, with steam or hot water heating element and two or more centrifugal fans . . . offering attractive styling, high capacity, and extreme flexibility of application.

WEBSTER-NESBITT SERIES C UNIT HEATERS remove practically every obstacle to your freedom of design and application in heating offices, showrooms, corridors, etc.

The family of five matched casings ranges in length from 34″ to 74½″. Heights are 22¾″ (for the small unit, Type B) and 29″ (for the four Type D units). For floor mounting, a 2″ base is provided. Three types of front are offered: *universal*, for fully exposed application; *semi-recessed*, for two depths of partial recess; and *fully-recessed*. The recess fronts extend beyond and conceal the rough wall opening.

Hence, Series C units may be installed in a variety of ways: floor-mounted, horizontal, wall, or inverted, and non-recessed, partially-recessed (two depths), or fully-recessed. Additional latitude comes of the fact that, with the universal front, the intake and the discharge can be through the face, the bottom, or the top of unit. Rear intake is available in floor mounting.

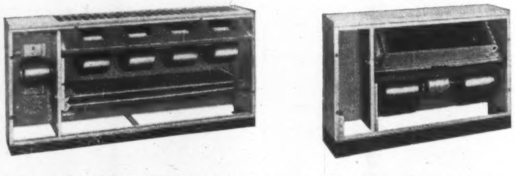
Once again the engineering, manufacturing and distributing facilities of the two great leaders in the heating field bring you equipment unsurpassed for beauty and construction, ease of application, and quiet, dependable performance.

Ask for Publication WN-136.

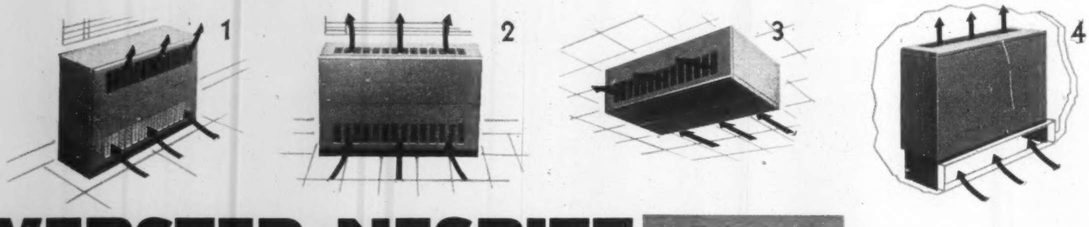
Heating elements are serpentine type, with round seamless copper tubing expanded to plate type aluminum fins. Elements are of two capacities for use with steam; one capacity for use with hot water.

Fans are forward-curved, double-inlet type, designed with their housings for large air volume at low tip speeds. The small unit, Type B, has two fans; the four larger units, Type D, have two, three, four, five fans.

Motors are resilient-mounted and constant speed (standard). Type B motors are 1725 rpm with a variable-pitch motor sheave (two-speed motors, optional). Type B are direct drive; Type D are belt drive.



Above: *left*, Type D, draw-through; *right*, Type B, blow through. Below: (1) face intake, discharge; (2) face intake, top discharge; (3) bottom intake, top discharge; (4) rear intake, top discharge.



WEBSTER-NESBITT SERIES C UNIT HEATERS

are Manufactured by
John J. Nesbitt, Inc., Philadelphia 36, Pa.
and Sold by Warren Webster & Co., Camden 5, N.J. with offices in principal cities

"OPEN FOR DISCUSSION"

• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

J. NELSON STUART —

"Compare Fuel Costs Before Deciding"

AFTER READING the article *Use Light or Heavy Oil* by Robert I. Anderson, as published in the April HPAC, and the comments by James B. Rishel in the May HPAC about this article, which were entitled "*In Selecting Oil Consider All Factors*," I feel that some explanation is necessary.

Some months ago Myron Hineline, chief engineer of the Milwaukee schools, in addressing the Wisconsin Association of School Business Officials cautioned his audience to analyze the future regarding liquid vs. solid fuels. He stated that in Milwaukee anybody paying more than six cents a gallon for No. 5 fuel oil would be paying more for their fuel than if they were burning coal. Mr. Hineline used as his yardstick 14,000 Btu per lb coal at $9.98 per ton.

In the example cited in Mr. Anderson's article, using Mr. Hineline's yardstick, coal would cost $534.53 compared to No. 5 oil, which would cost $950.00. This represents a saving of $415.47 in favor of coal. If school authorities were paying 2.5 percent interest on their bonds, this saving would service $16,618.80 of debt.

We certainly agree with Mr. Rishel's views that all factors should be considered. When they are considered, coal is found equal to or superior to oil on most counts. — J. NELSON STUART, Director, Market Promotion Dept., National Coal Association.

F. F. STEVENSON —

"Would Like More on CBS TV City Article"

THE ARTICLE on the air conditioning of Television City, by F. A. Sayler and J. M. Ayres, in the May HPAC, has many informative items for the designing engineer. Especially so are the figures given for the lighting loads in the large studios. These are much lower than those used several years ago in the air conditioning a couple of large studios that I designed for another network. The lighting load then, as worked out after consultation with the other network engineers, was 23 watts per sq ft against the figure of 11 watts used by Mr. Sayler and Mr. Ayres. However, the figure of 23 watts does not include the audience area — just the studio proper—but after allowing for this, it is evident that the lighting today is much more efficient per watt input and also that more is being learned about the correct usage factor.

From the figures quoted in the article, the total internal heat load seems to have been cut by more than 50 percent from the computations that I used just a few years ago. Undoubtedly, this is largely due to the reduction in the lighting.

I used about 6 cfm of supply air per sq ft of studio area, with an 18 F diffusion temperature difference, employing a similar overhead distribution as described in the article. It would be interesting to know the cfm per sq ft and the diffusion temperature differences used in Television City.

The outlet boxes on the bottom of the down risers are also worthy of comment. It would be informative, if the authors would tell what prompted their use of these boxes, which are equipped with four outlet registers, presumably discharging air in a horizontal plane, rather than one large ceiling diffuser, equipped with adjustable deflectors. Was it in the interests of economy or does the box and register design give a better air flow pattern for the special needs?

Designers would be interested in knowing the sound level of these outlets. It is noted that return air is taken from the upper areas of the large studios, above the lighting level. Is not such air at a temperature considerably above that of outside air during a large portion of the time?

It is noted that the design sound levels are quite a bit lower than those set by studio engineers a few years ago. This is a step in the right direction and should save considerable expense in the acoustical treatment of mechanical equipment and of air ducts.

Many designers would no doubt like to know how air is distributed in the studio control rooms, that is, the air which handles the normal load of the space, not that going to the racks. For instance, how much air is used per sq ft of space area, total air changes per hr, what kind of distribution fixtures are used and noise level thereof.

In the so-called technical areas, I found that good air distribution in the central control room and similar spaces, having long rows of racks, with a narrow aisle between, was very expensive. — F. F. STEVENSON.

THE AUTHOR'S REPLY — The 11 watts per sq ft referred to by Mr. Stevenson was not the design lighting load. It was the average lighting load actually used in the new facilities when a check was made about six months after occupancy. The design wattage was 44 watts per sq ft over 50 percent of the total studio area, or 910,000 Btu per hr per studio due to lights. The total sensible heat load was 1,080,000 Btu per hr which was handled by 48,000 cfm at a diffusion temperature of 21 F at the outlet. As indicated in this article, this amounted to 4 cfm per sq ft.

The entire question of lighting intensities for television studios is wide open, since no one really knows what lighting loads color television will bring. Each network or station has its own requirements and has to be treated separately. In general, however, we have used between 50 to 60 watts per sq ft with a 50 percent diversity in area for the average stations that are not likely to put on huge, lavish productions.

The square outlet box was used primarily in the interests of economy, but it also afforded additional directional air distribution by manual operation of the supply registers. These 20 in. x 8 in. registers delivering 480 cfm each are rated at 14 decibels.

As indicated in the article, the automatic temperature controls and the supply and exhaust fans are so arranged that the studio exhaust air is returned to the supply at peak cooling or heating loads only. During most of the time the studio air is exhausted to the outside.

The control room floors have two levels under the same ceiling, consequently, a cfm per square foot figure would be meaningless. The air supplied to the non-rack area of these rooms averaged 15 air changes per hr using a diffusion temperature at the outlets of 20 F. Conventional square ceiling outlets were used, and they are rated at a sound level of 22 decibels or less.

With regard to technical areas and power rack rooms, we might add that recently, CBS TV City added a color television control booth to one of their studios which required a large adjacent power rack room. The separate rack supply and exhaust system installed on the other booths could not be used, because the "open" type rack was required for continuous servicing. As a result, long slotted ceiling outlets were used to direct the air down against the open rack fronts, and then the warm air was exhausted to the outside through the top of each rack. This room required 60 air changes per hr in order to prevent the room air temperature from exceeding 90 F. — J. M. AYRES, Chief Mechanical Engineer, Pereira & Luckman.

ROBERT GREENWALD —

"Use Evaporative Cooling in Arnold Application?"

THE ARTICLE *Supply Cooling Air for Testing Generators and Alternators* by A. F. Arnold in the August HPAC provides another example of the growing use of air conditioning for industrial applications. In reading the article, I found several items with which I am not in agreement. It is my understanding that the permissible temperature of the supply air would be between the limits of 77 and 104 F and could approach either extreme without bad effects on the tests. Design conditions in this area, about 70 miles from Lima, Ohio, are 95 F DB and 75 F WB. I can recall no time in the last several years when the dry bulb exceeded the stated maximum of 104 F. It would then appear that the air was not being taken directly from outdoors and must have been subjected to a considerable heat source to reach the temperature of 122 F. mentioned in the article. If the air must pass through a very hot area before reaching the test equipment, then a well insulated duct would prevent some of the temperature rise.

With a normal design wet bulb temperature of 75 F, evaporative cooling would be practical for this application with an approach temperature of 5 F being possible. Cooling water from an evaporative cooler could be circulated through a water coil over which the air passed or through a spray system for direct cooling. Either method would be comparatively inexpensive and could be used effectively with wet bulb temperatures up to 85 F.

Mr. Arnold may have had good reasons for not wanting to use evaporative cooling that were not presented in his article. However, his opinion appears to be rather biased with regard to the use of package air conditioning units. In most cases I have found that a close coupled central station system compares very favorably with multiple package units in parallel and can be made to provide better control. In this case, the balance would be much more in favor of the central station system since the same air supply fans could be used, and the cooling system would then consist of only a cooling coil, filter bank and condensing unit. Control of temperature could be easily and closely held by the use of an evaporator pressure regulator on the coil and a method of capacity regulation on the condensing unit. A heating coil could be easily installed for temperature control in the winter if desired. The adaptability of the package units to use for comfort cooling in other parts of the plant should not be regarded as a factor if this is to be a more or less permanent test arrangement. While being used for comfort cooling in other areas, they would not be available for use when the cooling air had to be cooled. — ROBERT GREENWALD, Air Conditioning Engineer, Lumm Corp.

LEWIS SMITH —

"My Remedy is Simple and Effective"

I WOULD LIKE to reply to Mr. Alyea's comments in the August HPAC about his four articles, *How to Control Unit Ventilators in School Buildings,* which appeared in the October 1953 HPAC and the three following issues.

Mr. Alyea says he has never seen a zone control system which doesn't give intermittent operation in mild weather. There are several thousand such systems in operation and many are in school buildings.

He also says that my reference to the lack of constant differential across the pneumatic control valve as contributing to faulty control is incorrect. I am puzzled by this, because he refers to this several times and especially in his November 1953 article in HPAC. Quoting from this article, he says:

"Therefore, it is important that air discharge temperatures remain stable. In most unit ventilator installations, there are several factors that cause unstable or cycling discharge air temperatures:

"1) Room thermostat location. . .
"2) Lags in the system. . . . .
"3) Size of the control valve. . . .
"4) Variable steam pressure. . . . .
"5) Variable return line vacuum."

The steam pressure and the return line vacuum — or pressure — constitute the differential across the valve which I was talking about. The control of this differential is the main point of my argument. My remedy is especially simple and effective.

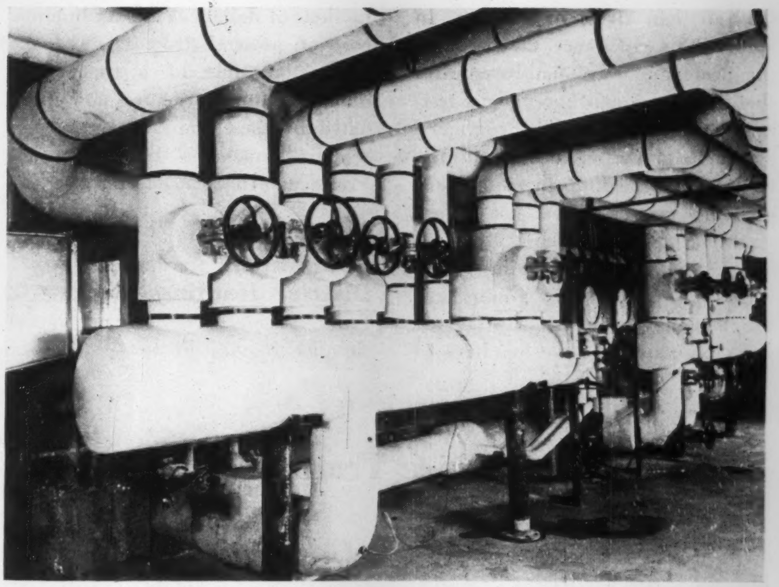
I am glad that he concedes that a simplified zone control system has some merit when associated with normal unit ventilator controls. My feeling is that he should be delighted to see a sub-atmospheric control used, because it would make the job of controlling pneumatically infinitely easier. — LEWIS SMITH, C. A. Dunham Co.

Editor's Note —

HTHW Article Needs an Addition

THE ARTICLE, *HTHW System Serves Personal Products Plant* 13 *Years*, by Lewis Smith and Steven Senko in the July HPAC, needs an addition.

Mention was made in the article that the J. O. Ross Engineering Corp. designed and installed the original distribution system and the heating plant described. However, it was not indicated that an addition to the existing plant was made when the Research Laboratory was built in 1951. The distribution lines and system for this addition were designed by the American Hydrotherm Corp., and the distribution header is shown in the accompanying illustration.



THIS DISTRIBUTION header was installed as an addition to the 13 year old HTHW system when the Johnson & Johnson Research Laboratory was built in 1951.

J. F. LINCOLN —

"I Suggest the Removal of Welding Restrictions"

MAN'S MATERIAL PROGRESS depends on how well and how economically in time and money he can join things together. This has been true since the dawn of history and especially true since the steel age began.

For over 40 years, arc welding has been a big factor in building the modern equipment used by man in every walk of life. However, progress is now being held back by limitations placed around the welding process by various codes, rules and regulations which are unduly severe.

These restrictions are promoted, no doubt, by well intending persons, but these persons do not see the economic folly of what they are doing. Arc welding has produced a record for reliability in billions of welds, over the years, that is unmatched by any other manufacturing process. Yet arc welding is being tremendously handicapped in its application. This handicap is throwing suspicion on the process by writing into specifications expensive and impractical tests which have little to do with the excellence of the weld.

These restrictions have already eliminated the economic uses of welding in many proper applications, and if continued, it will eliminate many others.

With modern arc welding equipment and electrodes and with proper technique, it is almost impossible to make a weld which will be weaker than a riveted joint. We see welding electrode specifications being written, however, which enormously increase the cost of production with no increase in either the reliability nor in the excellence of the structure.

Much time and expense is used in testing electrode deposits to make sure they have great ductility. The weld is rejected if its ductility is low. Yet riveted joints have no ductility, relatively speaking, and are accepted without question.

Every day we see riveted joints which are made tight by caulking. This is a standard accepted process. The resulting undercut is enormous yet a welding undercut that is almost infinitesimal in comparison is frequently made the reason for rejecting welds.

The contour of the deposit of the weld is a matter of close inspection but no one examines the contour of any rivet or the hole it may only partially fill.

Insured vessels must have their welds X-rayed, and we see welds chipped out and rewelded because of trifling porosity, yet no one X-rays a riveted joint. The same thing is true of many other structures outside of insured vessels.

Any excess strain placed on the welded structure will distort the rest of the structure and render that structure valueless for its intended purpose long before the weld would fail. Yet such testing and rejecting is made mandatory in many structures but never in riveted structures.

Castings, both steel and gray iron, are rarely required to be X-rayed, yet from the material of the castings, it is well known that many hidden defects are present.

Over the 40 years since arc welding has been in commercial existence, it has consistently done a more reliable job than rivets or castings. In spite of this experience, the engineering profession continuously requires these excessive and uneconomic tests and requirements. This continued suspicion of the engineering profession toward welding, in spite of its enviable record, does not reflect credit on the profession.

It is high time that welding be given its proper place in joining materials, without restrictions which are harmful. This will save hundreds of millions of dollars each year in lower cost of present structures and the making possible of a tremendous number of other structures now eliminated by these impractical and unscientific rules. — J. F. LINCOLN, President, The Lincoln Electric Co.

Editor's Note —

Committee Revises District Heating Report

SINCE PRESENTATION of the report *District Heating Develops* by John F. Collins, Jr. in the August HPAC, the figures quoted in the report of the number of district heating customers were revised by the committee, says S. S. Sanford, chairman of the committee.

The number of customers lost in 16 cities was only 37, decreasing the revenue of the utilities by $368,000 in place of the values quoted in the article. The new customers that were connected in 39 cities will bring the utilities a revenue of $1,799,380.

Improved Apprentice Training Goal of United Association Contests

WINNERS OF THE UNITED ASSOCIATION'S international apprentice contests were presented with prize award checks and engraved watches by Martin P. Durkin, UA general president. Also, all contestants received certificates marking their completion of the first annual international apprentice training conference, held in conjunction with the contests.

A NEW APPROACH to higher craftmanship to meet the challenges of the atomic age is the purpose of the annual International Apprentice Contests, the first of which was held last month at Purdue University, states Joseph P. Corcoran, United Association pipefitters apprentice coordinator.

Martin P. Durkin, general president of the UA, declared in his opening address that "new skills are required in fabricating the alloys necessary to withstand the high temperatures of jet engines, atomic powered submarines, and radioactive materials. Aluminum alloys, stainless steel, magnesium alloys, silicon-copper, and newer combinations are some of the challenging materials with which the pipefitter must work today."

While 300 union officials and representatives of the industry gathered for the opening session and discussions on apprentice training, related classroom instruction, and on-the-job skills, champion apprentices from 35 states, the District of Columbia and three provinces of Canada competed in a series of written and performance tests for cash prizes totaling $3500.

Prof. William H. Johnston of the department of chemistry, Purdue University, a conference speaker, said, "The world must resort to atomic energy to meet the power needs of the next 100 years." He stated that the world's energy needs for that period will be at least twice all the known resources of coal, oil, gas, solar energy, water and wind power. Maximum estimates, he said, indicate that perhaps 10 times the energy from these sources might be needed. "However, natural resources of fissionable atomic materials amount to seven times the minimum requirements — about a billion billion Btu."

Another speaker, Dr. George Manov, staff specialist for the Industrial Division of the Atomic Energy Commission, spoke on the use of radioisotopes as tracers in piping systems and the use of X ray photography in preventive maintenance. He also predicted the use of liquid metals as cooling mediums instead of water and described a special pump devised by the AEC to pump liquid metals.

Contractors and manufacturers, represented in the planning and leadership of the conference, also expressed a vital concern in improving apprentice training of craftsmen. Featured was an exhibit of materials and equipment, $10,000 of which was donated as permanent property of the apprentice training committee for future conferences.

Sparks Memorial Hospital

FORT SMITH, ARKANSAS

Another case of
COPPER
where it counts!

CARNAHAN AND THOMPSON ENGINEERS—Mechanical and Electrical Consultants, Oklahoma City, Okla.; **G. W. SHIRLEY & SON**—Mechanical Contractor, Van Buren, Ark. **FRASER CONSTRUCTION COMPANY, INC.**—General Contractor, Fort Smith, Ark. **E. CHESTER NELSON**—Architect, Fort Smith, Ark. **CRANE CO.**—Revere Dist., Fort Smith, Ark.

28,000 lbs. of Revere Copper Water Tube used for air and oxygen systems, hot and cold water lines

Here is an interesting example of the versatility of Revere Copper Water Tube. Because of the characteristics of copper tube it can be used to carry various fluids and gases encountered in hospitals without frequent replacement which would be necessary should rustable pipe be used. Also, the solder or compression fittings used with copper tube assure the tightest kind of joint possible, preventing dangerous leaks. Just check the many outstanding features of Revere Copper Water Tube in panel at right and you'll see that there is not another metal, alloy or other material that has all the outstanding construction characteristics of copper. Yet its initial cost, though slightly more in some cases, is much less per year of service.

Keep out of trouble with copper. Use Revere Copper Tube for air conditioning lines, radiant panel heating, hot and cold water lines, underground service lines, waste stack and vent lines, processing lines.

REVERE

COPPER AND BRASS INCORPORATED

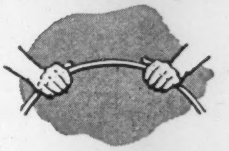
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

WHY REVERE COPPER WATER TUBE IS PREFERRED FOR AIR CONDITIONING



EASY TO BEND

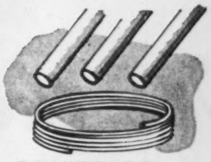
Saves Time

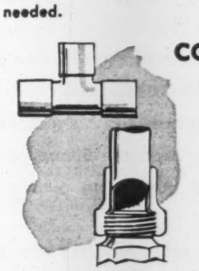
Revere Copper Water Tube is easy to bend. Soft temper can be bent by hand to meet installation conditions.

HANDY LENGTHS

Save Fittings . . . Labor

Revere Copper Water Tube comes in straight lengths of 20' in hard and soft tempers. 60' coils of soft temper reduce the number of fittings needed.





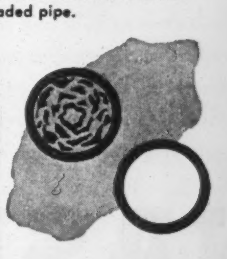
SOLDER OR COMPRESSION FITTINGS

Need Less Work Room . . . Save Metal

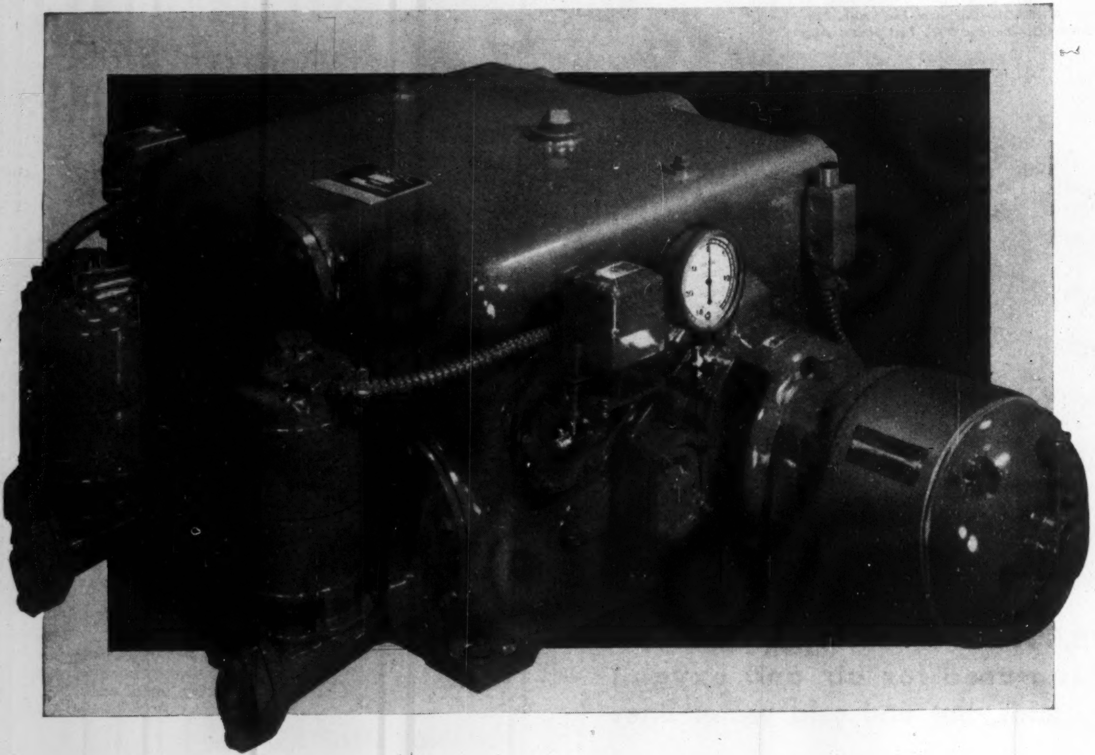
No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.

NON-RUSTING

Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.



THIS NEW VACUUM HEATING PUMP IS SIZED TO ACTUAL JOB REQUIREMENTS



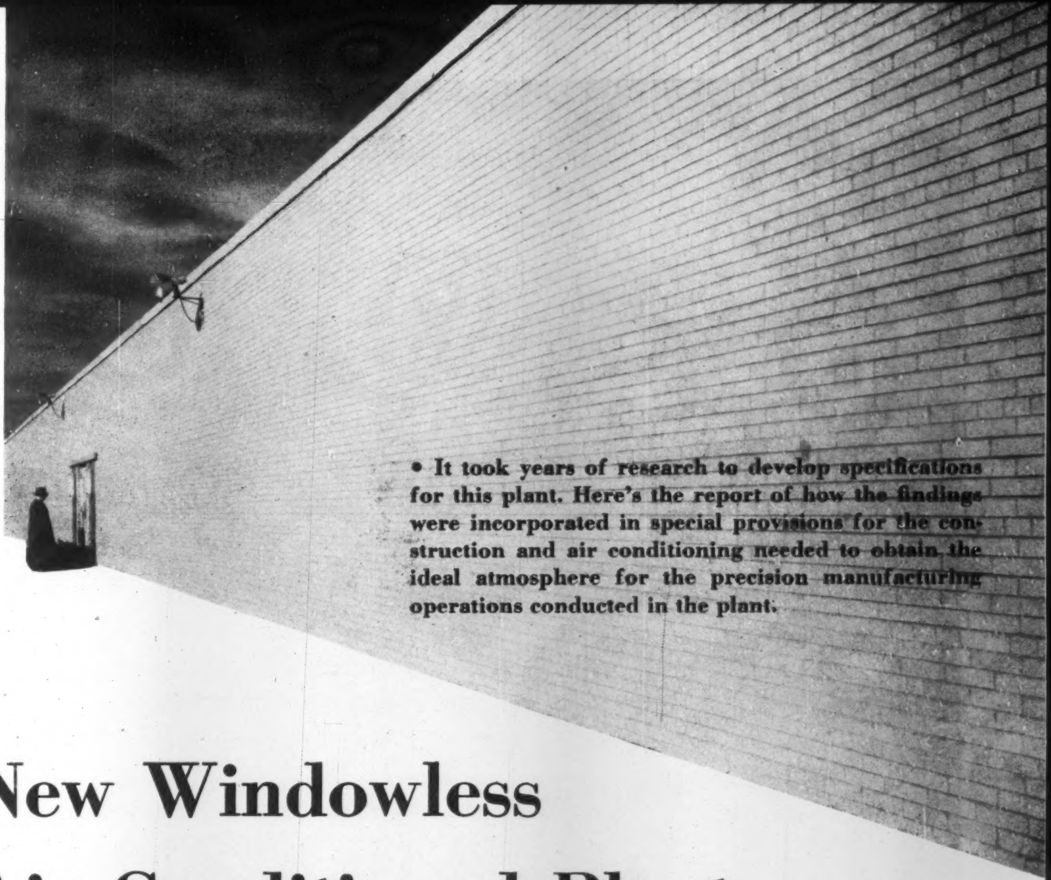
It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- ✓ **Increased air capacity induces rapid system response without wasteful overheating.**
- ✓ **Separate air and water pumps individually selected to meet actual job requirements.**
- ✓ **Control system that operates individual pumps only when needed.**
- ✓ **Flexibility permitting addition of radiation without changing basic pump installation.**
- ✓ **Low, low, return line connection.**

NASH ENGINEERING COMPANY
438 WILSON, SO. NORWALK, CONN.



• It took years of research to develop specifications for this plant. Here's the report of how the findings were incorporated in special provisions for the construction and air conditioning needed to obtain the ideal atmosphere for the precision manufacturing operations conducted in the plant.

New Windowless Air Conditioned Plant

. . . "made to order" for precision manufacturing

By D. R. Dooley
Vice President
C. P. Clare & Co.

THE NEW RELAY manufacturing plant of C. P. Clare & Co. in Chicago is an industrialist's dream in concrete form. Every construction feature has been planned and is executed to aid in the manufacture of the company's product under the most ideal conditions obtainable.

Carl P. Clare, president, and his engineering organization, in collaboration with Mason Rapp, of Rapp and Rapp, architects and engineers, spent years of research and tests on methods and materials to provide the ideal manufacturing atmosphere this new plant affords.

Exhaust at Work Points

The result is an air conditioned factory whose cleanliness, temperature, humidity and air circulation are automatically controlled at the exact points experience has proved necessary for precision work. All dirt, odors or heat created by manufacturing processes are evacuated at the source through underfloor air exhausts. These are but

DUST AND DIRT are primary enemies of electrical manufacturing. Air conditioning in this modern windowless plant is designed to reduce rejects and failures due to these factors.

a few of the advanced design features that make this new plant of unusual interest.

Dustproof Construction

Two of the main failures in making relays are: (1) a conductor may become an insulator, or (2) an insulator may become a conductor. In either case, dirt is usually the cause. The new plant is as dust tight as a factory can possibly be.

There are no windows in the manufacturing area of the 50,000 sq ft plant, and the walls are of 8 in. brick, lined inside with 2½ in. ceramic tile and with a 1 in. air space between. The entire roof is insulated with a 1 in. thickness of insulation, on which a 3 in. gypsum roof covering was poured.

THE NEW air conditioned plant is windowless except for a large glass area for the reception room in the front.

The plant ceilings are only 9 ft, 3 in. high, and they are covered with alternate rows of perforated acoustic tile and enamel steel plain tiles, with rock wool insulation between them and the roof beams. This construction seals out the hazard of dust from above.

Floors are covered with a light colored asphalt tile which provides a resilient, quiet and dust free surface, which, like the walls and the ceilings, is easy to keep spotlessly clean.

Air Electrostatically Cleaned

Before being circulated, air is passed through a bank of self cleaning electrostatic precipitators. Thus, the dust and smoke particles in the air are removed from the air stream by electrical attraction.

In the air conditioning system, the air is heated or cooled, humidified or dehumidified before it is circulated through the plant. This circulation system is unusual in that from five to six times the usual number of directional registers and diffussers for air supply are in the plant ceiling to increase the supply of conditioned air to working areas.

Even the locker rooms are provided with unusual facilities for clean and conditioned air. Lockers, which are perforated at the front and bottom, are mounted on air ducts through which air is continuously exhausted.

Since all supplies of power and air for benches and machines are carried through an elaborate system of ducts and outlets in the floor, there is nothing suspended from the ceiling to catch and hold dust or dirt. These special features, plus the washable floors, walls and ceilings, give an effective control of the inside air that is rarely found in industry.

SOLDERING AND OTHER manufacturing processes which give off odors, dirt, smoke or heat are exhausted at the work benches or machines where they occur.

Good Lighting Also Helpful

Precise relay manufacturing involves the hand assembly of many small parts. It is only with the utmost in proper lighting facilities that accurate assembly can be maintained.

The lighting system consists of slim lined flourescent tubes in continuous rows on 4 ft centers. It provides 75 ft-candles at work bench level, which is approximately eight times the effective lighting used in most industrial plants. It is completely shadowproof, and tests have shown that it eliminates eyestrain entirely.

Benefits for Employees

The new plant's unusual atmospheric and lighting conditions allow the employees to spend their working hours under ideal conditions of temperature, humidity and light.

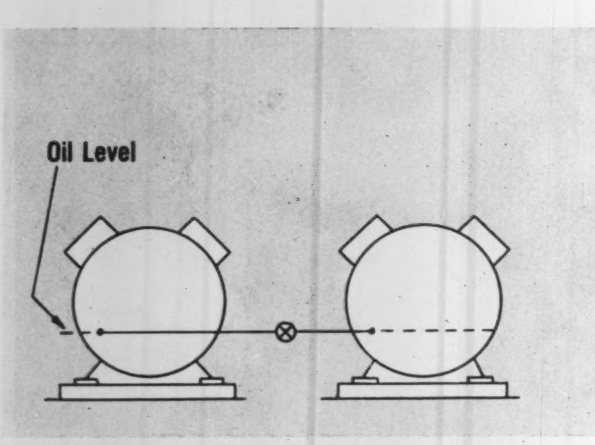
In addition to the most modern locker rooms and washroom facilities, plans call for a pleasant eating room, a recreation room and open air recreation facilities to be constructed in the near future. The grounds about the building are park like in their landscaping.

How Many Kilowatts In One Pound of Coal?

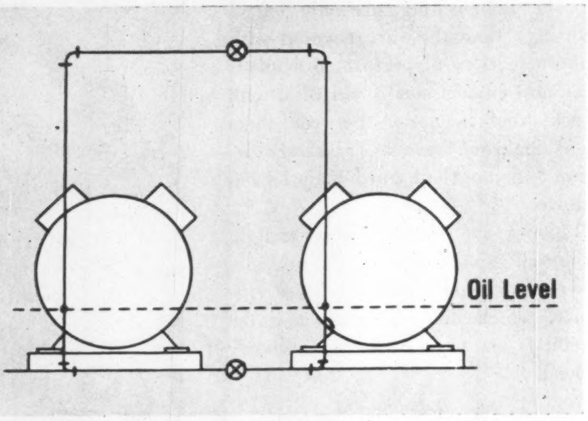
THE "coal rate" of all coal burning utility stations reached exactly one pound per kilowatt in April 1954, according to a recent official announcement by the Federal Power Commission. This marks a milestone in power generation.

In 1920 it took three pounds of coal to generate a kilowatt; by 1925 the average was two pounds, and the 1953 average was 1.06 lb per kw. No prediction for the future was given.

In these compilations, one pound of coal is considered to contain 13,100 Btu, as fired.



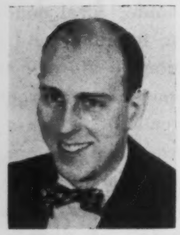
1 EQUALIZER PIPE should be at normal oil level if compressors have a single equalizer tapping in the crankcase



2 THIS PIPING arrangement can be used to provide a passageway between compressors having a single equalizer tapping

How To Hook Up Refrigerant Piping

Two or more reciprocating compressors can be operated successfully in parallel in one refrigeration system, even though many designers shy away from such systems, says the author in this first of three articles.



By Lincoln R. Scafe

Manager, Service Dept.
The Trane Co.

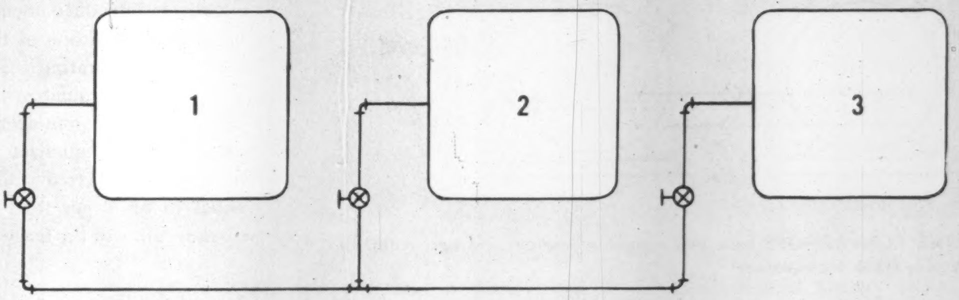
WHILE THERE may be certain secondary factors that cause many designers to shy away from connecting two or more reciprocating compressors in parallel in one refrigeration system, plus the fact that naval specifications sometimes forbid the practice, the principal reason for their avoiding such a hook up are:

a) The inability to maintain proper lubrication in all the machines involved.

b) Lack of knowledge in proper procedures for successful refrigeration piping.

Equalize Crankcase Pressures

In a successful installation, each compressor operating in parallel must have the same proper lubrication as required for a compressor operating singly. To accomplish this, it is absolutely necessary to equalize crankcase pressures in the machines. Too often, in the past, improper equaliz-



3 WITH THREE or more compressors in the system, the single pipe crankcase equalizer should contain isolating shutoff valves

ing devices have caused one of the compressors to lose its oil charge because the crankcase pressures were not equalized. This, of course, has resulted in serious damage to the machine and a resulting hesitancy in designing such systems.

It is also important that the lubricating oil in the system return uniformly through the suction line to each machine. If the piping is not installed properly, the oil will be returned unevenly. The result has been compressor damage and a reluctance to use a system where the opportunity for damage is great.

However, it is entirely possible to equalize crankcase pressures of each compressor. Improved know-how in the science of refrigeration piping makes it possible to return oil from suction lines evenly to each compressor in the system under all conditions of operation.

Obviously the risk of damage is still there, but good practice can reduce the risk to a decided minimum. Even though every suggestion made in this series of articles is followed carefully, failure may still occur because of other improper piping practices.

The single pipe crankcase equalizer is the best assurance for a successful installation, according to the latest research studies. With a single equalizer, there is less possibility of robbing oil from one or the other compressor. Most modern reciprocating compressors are designed with a single equalizer tapping in the crankcase so that a single pipe crankcase equalizer can be used as shown in Fig. 1. However, a single pipe equalizer should never be used on reciprocating compressors having two equalizer tappings into the crankcase.

Same Size Compressors

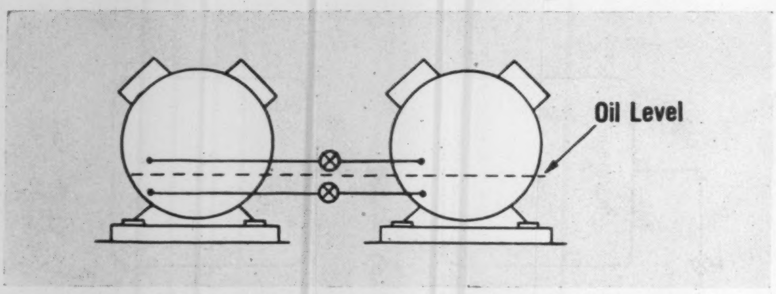
The single equalizer tapping should be installed so that the bottom of the inside of the equalizer pipe is at the normal oil level. It is also necessary that the oil level in all machines be at a common level. To insure the most trouble free installation, the crankcase of each compressor should be of the same size or of equal volume. Obviously, then, the paralleling of various size compressors such as a 20 ton unit with a 40 ton unit is definitely not recommended. Under certain conditions, the larger machines would have a tendency to pump oil out of the smaller machine with damaging results. By the same token, all machines in the system should be as nearly alike as possible in piston size and displacement.

The single equalizer should be as short as possible and perfectly horizontal between connecting machines. Any valves in the crankcase equalizer should be installed with the stems horizontal so no false levels are created in which oil has to rise over the valve seat.

Passageway Provided

A second arrangement of the single pipe crankcase equalizer can be made when a passageway between machines is desired as shown in Fig. 2. Even though this arrangement uses two pipes, it is still only a variation of the one pipe equalizer and should not be confused with the two pipe equalizers mentioned above. In this alternate arrangement, a nipple is connected to the single pipe tapping of each compressor. A tee is placed at the opposite end of the nipple, thus breaking the single pipe arrangement into two channels. The one channel can be piped overhead, the other at floor level.

With the regular one pipe crankcase equalizer, the single channel carries both the gas and the oil to equalize crankcase pressures. With the divided channel arrangement, the overhead piping will carry the gas and the floorline piping the oil. Both arrangements function equally well when properly made. The second, of course, requires more piping but does make passage between machines possible. Extra oil will have to be



4 SOME COMPRESSORS have two equalizer tappings and thus require a double pipe crankcase equalizer

added to fill the equalizer line below the oil level of the compressors.

Three Or More Compressors

If three or more compressors are used in the system, the single pipe crankcase equalizer should be arranged so that each compressor can be completely isolated as shown in Fig. 3. This is accomplished by placing the isolating valve in a branch line from the compressor to the equalizer.

Equalize Separate Condensers

The equalization of pressure is probably easiest accomplished when a single condenser is used for the entire multiple compressor system. In such cases, only the crankcase pressures need be equalized. A multiple system with condensers for each compressor is more difficult. But even this can be accomplished if all condensers are treated as a single condenser.

In those cases where separate condensers for each compressor are required, extreme care in equalization is necessary. As indicated previously, the condensers should be arranged so they operate as a single condenser. This is done by equalizing the hot gas discharge lines before they enter the condensers. This is the most critical point in the piping system. It is here that pressure drop is extremely important; one half a foot of pressure drop is equal to one foot head of liquid. Excessive pressure drop in the equalizer may rob one condenser of all its liquid by forcing it all into the other condenser. As a result, large quantities of hot gas may be pumped into the liquid lines from the condenser of the compressor that is operating. This materially reduces the capacity of the entire system.

The hot gas equalizer should be just as short as possible. Long equalizers introduce unequal pressure in condensers if one of the compressors is not operating. The refrigerant then accumulates in the condenser of the non-operating compressor. The equalizer should also be generously sized and should be equal to or larger than the hot gas discharge line of the large compressor.

Double Pipe Crankcases

Certain compressors are arranged for double pipe crankcase equalizers as shown in Fig. 4. In such cases, the compressor is arranged with two equalizer tappings, one above the oil level, the other below. The tappings are connected with horizontal level pipes. The top pipe in such installations serves to equalize the gas pressure, while the lower tends to equalize the oil pressure. The principal disadvantage in this arrangement is the possibility of fluctuation in crankcase pressures which cannot be immediately overcome by the gas equalizing line. In such cases, oil from the compressor with the high crankcase pressure will be pumped through the oil equalizing line to the other compressor. The oil ordinarily will return when pressures become equalized, however, but not until the bearings in one compressor have momentarily run short of oil. This problem can be minimized somewhat by a gas equalizer pipe of generous size.

Sam Houston Coliseum to be Air Conditioned

. . . 12,000 seating capacity

HOUSTON municipal officials stride ahead in maintaining their claim for the title of "the most air-conditioned city in the world." Keeping pace with this claim, the famous Sam Houston coliseum is now to be completely air conditioned, according to the Sturtevant Div. of Westinghouse Electric Corp.

With a seating capacity of 12,000, the huge coliseum is the center of Houston's cultural, educational and spiritual life as well as much of its entertainment. So versatile is this giant structure that it may be used on successive nights for an ice skating show, a basketball game and a convention exhibit show.

Four surface dehumidifiers, two fans plus water and steam coils will supply the air conditioning and heating requirements. Two 600 hp motors will drive centrifugal refrigeration machines and there are many smaller motors for fan and pump drives.

Water coils are to be mounted in ductwork of existing heating units, handling re-circulated air only. The four surface dehumidifiers, fans and steam coils will furnish cooled outside air for ventilation purposes through a new system of ductwork and air outlets.

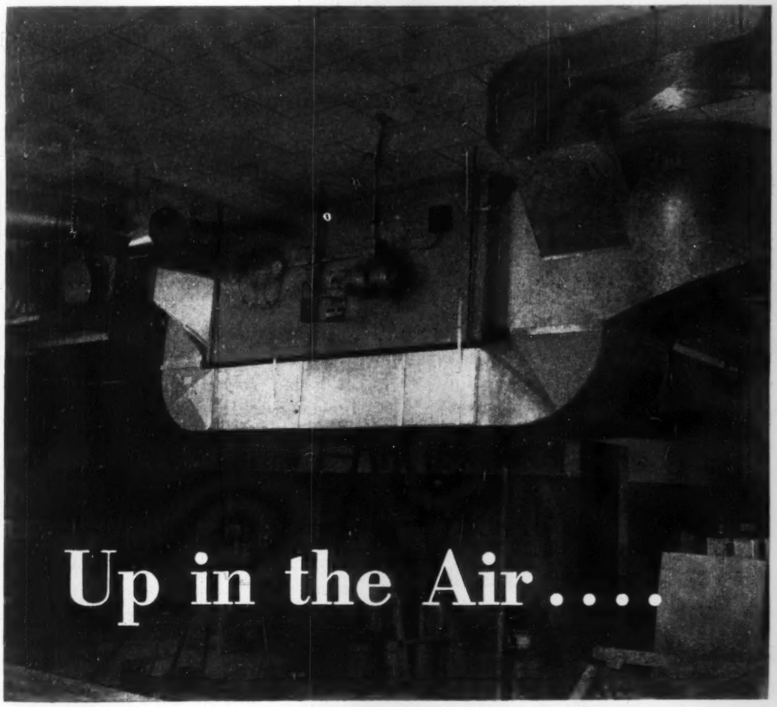
Consulting engineers for the installation are Dale S. Cooper and Assoc., of Houston.

The heating and air conditioning contractor is Natkin & Co., also of Houston.

NATIONAL
Serving You Better
NATIONAL
NATIONAL'S GRAND OPENING

1 NEW SUPERMARKET in Detroit area has overhead heating and cooling installation. Two of the supply outlets, all in the ceiling, are just inside the doors shown above

2 ONE OF TWO oil fired duct heaters, showing overhead installation. Note cooling and circulation unit at left



Up in the Air....

... and out of the way is the heating and air conditioning in this new store

By T. E. Trese,
President, OverHead Heaters, Inc.

IN A NEW National Food Stores supermarket recently opened in the Detroit area, heaters, circulation units, cooling coils, ducts and outlets, with the exception of return air ducts, are all overhead. The units are installed in a storage room at the rear of the building. The overhead arrangement saves floor space and permits flexibility in installation.

On the basis of a calculated heat loss of 750,000 Btu per hr, two oil fired duct heaters using No. 2 fuel oil are installed for the heating load. Cooling load is 318,400 Btu per hr.

The duct system was designed to circulate the air in the building for both summer cooling and winter heating. For this purpose, two ceiling suspended air handling units with cooling coils were chosen. Approximately 10,640 cfm will be delivered for the heating cycle and 13,200 cfm for cooling.

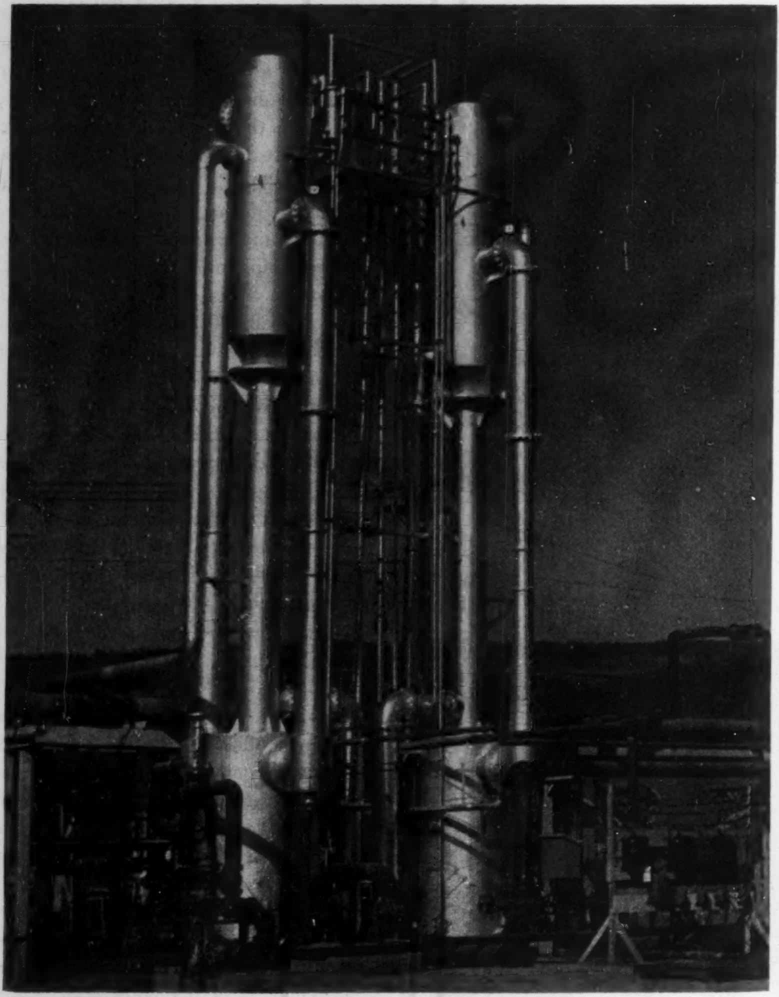
Conventional thermostats are used to control the two duct heaters. The cooling coils are supplied by one 45 hp radial compressor, which is controlled by a separate cooling thermostat. The air conditioning system is operated 24 hr a day during the cooling season.

For summer cooling, the duct heaters are bypassed. Dampers are manually operated because the company has a maintenance staff familiar with this type of installation.

Supply outlets, all overhead, are carefully spaced away from open freezers. The supply ducts, are in the attic space and are insulated. Return air ducts are under the concrete floor and connect to risers behind the storage room partition. Outdoor air is introduced at all times the fan is operating.

Since both the heating and cooling equipment are ceiling suspended, it was decided to use bar joist construction in the building in order to obtain the needed support. The overhead units were hoisted into place by the use of chain falls. All this was done before the ceiling was installed. Provisions for venting are the same as for conventional units.

A. J. Segal & Sons is the heating contractor. The architect is C. Fraizer.



THIS 600 TON steam vacuum refrigeration unit is used by a penicillin manufacturer which uses special two stage counterflow barometric condensers

Steam Vacuum Refrigeration

• Special piping considerations and how to control the steam for steam vacuum refrigerating systems are outlined in this second and concluding article on the subject by Mr. Spencer.

The principle of operation, operating costs, selection of equipment and a number of applications were described in the first article in the August HPAC.

By Elliot Spencer

Graham Mfg. Co., Inc.

THE CHILLED WATER piping for these systems is similar in most respects to the chilled water piping for other refrigeration systems. However, there are several important considerations and precautions which must be taken to assure satisfactory operation.

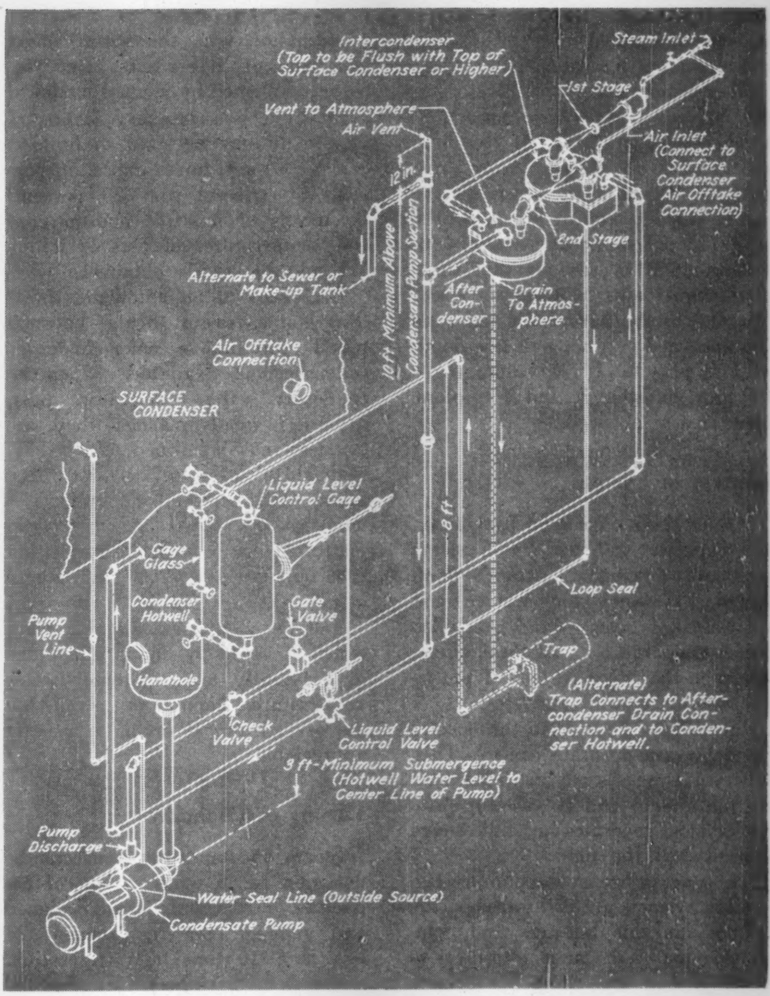
Since the evaporator is under vacuum, it is necessary to locate it above the inlet to the centrifugal chilled water pump. Elevation of the evaporator should be about 4 to 5 ft above the inlet to the centrifugal pump, and the line to this pump should drop vertically from the flash tank or evaporator with short horizontal runs. This pipe should be sized no smaller than the pump suction inlet. It is important that the manufacturer's recommendations be followed in sizing this line and in positioning the pump.

The centrifugal chilled water pumps must operate at a low net positive suction head unless, of course, it is convenient or necessary to locate the refrigerating unit in the upper floor of the building and is then possible to install the pumps at some lower level. In general, however, chilled water pumps must operate under the low suction head condition, and care must be taken to select the proper pump. It is well in arriving at this selection to consult both the manufacturer of the steam vacuum refrigeration equipment and the manufacturer of the pump as improper pump selection will, of course, result in unsatisfactory operation. In fact, it is probably preferable when writing specifications to require that the manufacturer of the equipment furnish the pump as part of the system and incorporate it in the overall system guarantee.

Where shell and tube or surface type condensers are used, conventional piping procedures and conventional pumps may be used for the condenser water supply. The use of surface condensers imposes a requirement for condensate removal which, of course, means that condensate pumps should be used for any reasonable size system. A recommended piping system is shown in the accompanying drawing.

Where possible, it is recommended that the loop seal be used in place of the trap, since this avoids possible trap difficulties. One precaution which must be taken in cases where condensate is wasted involves the use of a back pressure valve in the system. Without this valve, fluid will not be properly circulated through the return line to the hot well on the condenser. This would result in an inability to maintain the correct liquid level in the hot well and a proper net positive suction head on the condensate pumps. Without this valve, it is possible to lose vacuum by air returning through this line to the condenser. As an alternate, a high loop may be installed on the pump discharge.

These comments on condensate piping around the surface condenser apply to all surface condenser applications. Recent experience in the New York City area, where many buildings are furnished with street steam with no provision for condensate return, has shown that a back pressure valve is sometimes neglected by the engineer in planning the project. It is necessary to install one before satisfactory operation of the condenser can be acheived.


Intercondenser (Top to be Flush with Top of Surface Condenser or Higher)
Steam Inlet
1st Stage
Vent to Atmosphere
Air Vent
12 in.
Air Inlet (Connect to Surface Condenser Air Offtake Connection)
2nd Stage
10 ft Minimum Above Condensate Pump Suction
Alternate to Sewer or Make-up Tank
After Condenser
Drain To Atmosphere
Air Offtake Connection
SURFACE CONDENSER
Liquid Level Control Gage
8 ft
Gage Glass
Loop Seal
Condenser Hotwell
Gate Valve
Pump Vent Line
Trap
Handhole
(Alternate) Trap Connects to Aftercondenser Drain Connection and to Condenser Hotwell.
Check Valve
Liquid Level Control Valve
3 ft-Minimum Submergence (Hotwell Water Level to Center Line of Pump)
Pump Discharge
Water Seal Line (Outside Source)
Condensate Pump

THE USE OF surface condensers requires the removal of condensate by pumps for any reasonable size system. A recommended piping system is shown here

Size Tail Pipe Generously

When barometric condensers are used, it is important to avoid any horizontal runs in the tail pipe. A slope of 30 deg from the vertical is about the greatest deviation that should be attempted. For the best results, a straight 34 ft drop is preferred. The tail pipe should be generously sized to permit the disengagement of flash vapors. The use of a small tail pipe may result in noisy operation and fluctuation in the condenser vacuum — producing a lower operating efficiency. Horizontal runs tend to produce effects similar to the selection of a small tail pipe.

Condenser water pumps offer no special problem and are selected in the ordinary fashion. It is possible with steam vacuum systems to locate the flash tank remote from the ejectors, the ejectors remote from the condensers or any combination of these two possibilities. When the ejectors are located at some distance from the flash tank, as is often the case in the direct flash cooling of fluids for process industry applications, the lines from the flash tank to the suction inlet of the ejector must be carefully sized so that the pressure drop is kept to a minimum. It can easily be seen that this pressure drop imposes an artificial load on the system. For example, let us assume that we are chilling water to 45 F and the jets must be remote from the evaporator. Also, assume that the piping from the vapor to the jet imposes a pressure drop of 0.02582 lb per sq in. absolute. Since the equivalent of 45 F water is 0.14752 lb per sq in. absolute, in order to produce this vacuum in the evaporator, the jets will have to operate at 0.12170 lb per sq in. absolute, which is the equivalent of 40 F. It can be seen that in such systems the lines must be amply sized with a minimum of bends in order to prevent larger original equipment investments and greater steam requirements.

The piping from the ejector to the condenser must also be amply sized. Pressure drop in this line will impose an artificial back pressure on the ejector, which is the equivalent of operating the condenser at a higher condensing water temperature. It is obvious that these lines should also be properly sized. The end of the barometric tail pipe is submerged in a hot well to a depth of 1 ft plus 40 D^2/A, where D = tail pipe diameter, ft, and A = plane view area of hot well, sq ft.

Control of System

As has been discussed previously, the capacity will vary with steam pressure, condenser vacuum — affected by water temperature and quantity flow rate — and by chilled water temperature. All these effects are such that they are not of practical use for control purposes.

Steam may be bled to the booster jet achieving accurate control. This, however, imposes an artificial load on the system and is wasteful since the system operates at full steam capacity all the time.

In general, steam vacuum refrigeration systems are controlled by the use of multiple boosters and compartmented flash tanks. Control is accomplished by using a thermostat, which is immersed in the chilled water line discharge and which operates a shut off valve in the booster steam line. When multiple boosters are used, the flash tank is divided into compartments — each compartment operating in conjunction with its corresponding booster. As the load increases or decreases, a booster will be turned on or off, and the water valve of that compartment will be opened or closed in coordination with the steam valve. This same procedure may, of course, be accomplished by manual methods.

Multiple boosters may be equal in size or may be sized to fit load variations; say, for example, 50 percent, 30 percent and 20 percent. By means of multiple booster control, temperatures of plus or minus 1 F may be readily obtained.

By means of an automatic throttling valve, steam to the boosters may be throttled as cooler condenser water becomes available. When the condenser water temperature falls, a point is finally reached where the boosters may be turned off entirely. Manual throttling of steam to the boosters with lower condenser water temperatures is possible, but automatic control is so inexpensive that it is not necessary to do this manually.

The exact amount of steam which is saved by taking advantage of seasonally low condenser water temperatures cannot be given but the overall annual saving is usually appreciable.

Variety of Capacities

Steam vacuum equipment can be designed for a wide variety of capacities. Units have been designed and supplied for requirements of less than 10 tons of refrigeration, and systems have been furnished for refrigeration loads in excess of 1000 tons. There is no practical limit to the ultimate size of such systems.

The reliability of steam vacuum refrigeration is probably its greatest asset. With the chilled water pump its only moving part, maintenance and supervisory costs are low. Records of one manufacturer show that the average yearly spare parts cost for these systems can conservatively be given as about $20. Refrigerant losses are non-existent since the only refrigerant is the circulated chilled water itself. Control of these systems may be manual, semiautomatic, or fully automatic, requiring no more attention than others.

Steam vacuum systems respond to increased chilled water temperature rapidly. This high overload capacity results in quick pull down and great safety in load selection. A slight increase in chilled water temperature results in a large increase in capacity. This one factor accounts in a large part for the popularity of these systems in the chemical and process industries, where process changes due to variations in products can vary the load considerably.

Manufacturing Pharmaceuticals

A 600 ton steam vacuum refrigerating unit that is used in manufacturing pharmaceuticals is shown on page 96. This unit is supplying low temperature water for the condensing cycle of the customer's penicillin process. Each element is equipped with a low pressure booster for basic load operation, together with a high pressure booster that is fully automatic in its control. The barometric condenser of this unit is a unique two stage type which utilizes 20 percent less water than the conventional single stage barometric condenser.

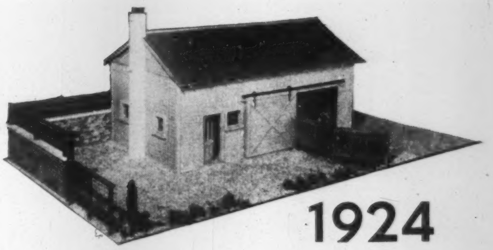
Numerous other applications could be cited, but there is no point in detailing them here. It should suffice to say that steam vacuum refrigeration can be applied adequately whenever chilled water or product temperatures above 35 F are required and sufficient steam and water are available at reasonable cost.

Heat Pump Serves Power Co-op

. . . for year around air conditioning

DESPITE UNFAVORABLE outdoor design conditions, a heat pump is being used successfully to provide year around air conditioning for office areas and various laboratories at the Dairyland Power Cooperative headquarters building in La Crosse, Wis., according to The Trane Co. In selecting the method of air conditioning various areas of this building, a heat pump was considered practical and economical because of low power rates and the availability of a satisfactory heat source in the form of well water.

To get the proper balance of heating and cooling loads, a condition considered necessary for a successful heat pump application, the heating capacity of the heat pump is supplemented by the building's conventional heating equipment. This reverse cycle system results in efficient use of standard cooling equipment throughout the year and a reduction in the size of the heating plant needed for the building.



1924

WRAY M. SCOTT CO. INC.

1954

"Experience Is Still the Best Teacher"

. . . says Wray M. Scott after 30 years in the heating, piping and air conditioning contracting business.

When Wray M. Scott and Roy C. Langston decided to go into the contracting business in Omaha, on March 1, 1924, their first office and shop was a barn at the rear of a residence. Incorporated for $50,000 with a total invested capital of $1300, the Scott & Langston organization was in business. Helen B. Scott, wife of Wray M. Scott, was the office girl.

Today, 30 years later, the Wray M. Scott Co. Inc., occupies the whole block. The original small service truck has been replaced with a fleet of 16 trucks and many major pieces of special equipment. And from the original heating and allied lines, the services and facilities of the company have branched out to include air conditioning and industrial piping as well, with one of the middle west's largest pipe fabricating establishments.

How has this growth come about? The story is told in a 48 page brochure celebrating the company's 30th anniversary of service.

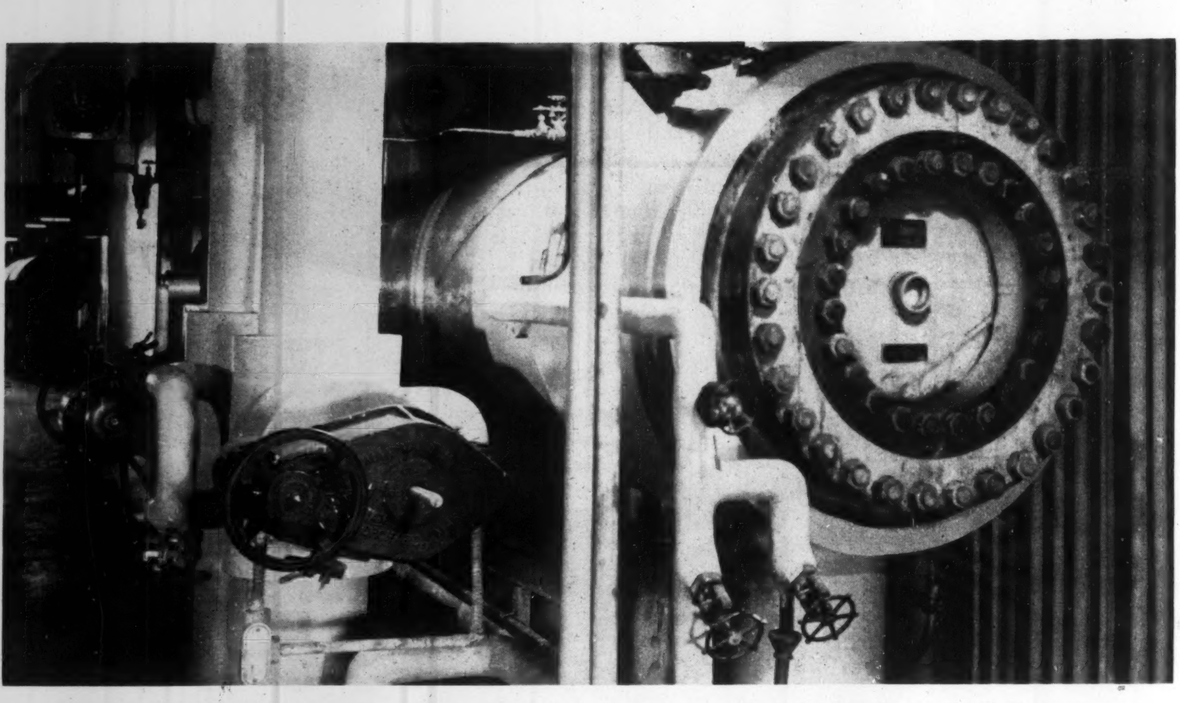
"We have grown," is the modest way Wray Scott puts it, "by hard work and reinvesting profits in the business."

Expansion and progress, which have marked a steady course in the history of the company except during four years of depression, were manifested very early. Reorganization took place when Mr. Langston decided the first year to sell his interest to Mr. Scott. In May, 1925, the name included only Wray M. Scott, and the company moved to a building twice as large as the old barn. However, this was soon too small. In 1927 a pipe shop and garage were added, but these quarters were outgrown also. The company moved again in 1930 into a new building to which other additions have been added.

Over 52,000 Jobs

In the 30 years of its existence, the company has completed over 52,000 jobs. They have been of every description, up to multimillion dollar piping jobs. "Experience is still the best teacher," says Mr. Scott.

He adds, "Our aims and ideals are the same now as they were 30 years ago, that of rendering a complete heating, air conditioning and industrial piping service in our territory."



SHUTOFF VALVES at feedwater heaters Nos. 1 through 4 are motor operated, can be closed automatically in emergency

New TVA Steam Plant's Piping Design

By Roy E. Lyon
Mechanical Engineer, Design Div.
Tennessee Valley Authority

• The author describes in detail the design considerations of this complete piping installation, including the piping for the main and reheat steam, boiler feedwater, extraction steam, drains, vents and blowdown, the systems for raw service water, compressed air and oil storage and transfer.

IN THE DESIGN of the various piping systems for the new Widows Creek steam plant, five miles west of Bridgeport, Alabama, on the west bank of Guntersville dam reservoir, the following points were given major consideration:

a) Safety of equipment and personnel.

b) Suitability of materials.

c) Costs.

d) Operating and maintenance convenience.

All piping was designed, fabricated and installed in accordance with appropriate sections of the code for pressure piping and the ASME boiler code in effect at the time of design.

This station is the third steam generating plant to be designed and built by the Tennessee Valley Authority. The six units in the plant have a combined capacity of 750,000 kwhr. The steam conditions under which the piping was designed are 1450 psig, 1000 F for the first four units, while the other two are reheat units with steam conditions of 1800 psig, 1000 F at the turbine stop valves and with reheat to 1000 F.

Main and Reheat Piping

The main steam piping is low alloy steel, forged and bored. Units 1 through 4 were designed and fabricated before restrictions were placed on the use of molybdenum, so the pipe conforms to ASTM specification A182, symbol F22, containing 2¼ percent chrome and 1 percent molybdenum. Due to restrictions imposed later, together with a revision in allowable stresses by the boiler code, the pipe for units 5 and 6 conforms to ASTM specification A182, symbol F11, containing 1¼ percent chrome and ½ percent molybdenum.

No valves are used in the main steam lines between the turbine stop valves, and the superheater outlet header and the piping are welded throughout.

A study of the plant arrangement indicated that, from a space standpoint, the turbogenerators should be on the center line and in front of the steam generators. This arrangement gave the shortest distance between the superheater and reheater outlet headers and the turbine, but it posed a problem of providing flexibility.

A comparison of costs between large expansion bends and extending the small superheater and reheater tubes forward and down a short distance in front of the furnace to provide this flexibility, indicated a considerable saving could be made by following the latter procedure. Preliminary drawings of the line were made and the stresses and moments were calculated. Scale model tests of the layout were then made to check the design. In all cases, the allowable stresses in the pipe and tubes and the reactions on the turbine and steam generator were well within the limits set by the boiler code and the equipment manufacturers.

The reheat steam lines for units 5 and 6 are seamless chrome-moly steel conforming to ASTM specification A158, symbol P11, designed in the same manner as the main steam piping.

The low temperature return steam lines from the turbines to the reheaters are carbon steel conforming to ASTM specification A106, grade B. Since the turbine outlet connections and the reheater inlet connections are relatively stationary, provision for expansion was made by bends and turns in the piping. The stresses in these lines were calculated and confirmed by scale model tests.

Boiler Feedwater Piping

Six stages of feedwater heating are provided for the non-reheat units and seven stages for the reheat units, with No. 4 heater in all cases being of the open, deaerating type. Condensate is pumped from the condenser hotwell through the low pressure heaters into No. 4 heater. From No. 4 heater the water flows to the suction of the boiler feedwater pumps and is pumped progressively through heaters Nos. 3, 2 and 1 to the steam generator.

All piping between the condenser hotwell and the boiler feedwater pump suction is schedule 40 seamless steel conforming to ASTM specification A106, grade B. All piping between the boiler feedwater pump and the steam generators is schedule 160 seamless steel conforming to ASTM specification A106, grade B. All joints are welded, except at the following points where flanges are provided for servicing equipment:

a) Condenser hotwell outlet.

b) Hotwell pump suction and discharge.

c) Deaerator inlet and outlet.

d) Boiler feedwater pump suction and discharge.

e) Condensate regulating valve inlet and outlet.

All valves are cast steel body, conforming to ASTM specification A216, grade WCB, with stainless steel trim. All gate, globe, and check valves are welded into the line and all large valves in the boiler feedwater pump discharge lines are motor operated. These three way valves are in the condensate line to the low pressure heaters to bypass the condensate around the heaters during startup or in case of difficulty with the heaters or controls thereon. Similar valves are also provided to bypass the boiler feedwater around heaters Nos. 1, 2 and 3 during startup or in case of trouble with the heaters.

The boiler feedwater pumps are driven by constant speed motors through fluid drives, thus providing the necessary speed variation of the pumps to maintain the water level in the steam drums. This eliminates the need for feedwater regulating valves in the pump discharge system as well as effecting a saving in the cost of operating the plant.

Make-up water for the steam generators is normally provided by evaporators but may be provided from storage tanks — built into the substructure of the powerhouse. These tanks — one per unit — are connected into the feedwater system ahead of the No. 4 heater in such a way as to provide for surges in the system and to provide a supply of water for sealing turbine and pump glands, etc. Level controllers on the No. 4 heaters control diaphragm valves in the make-up and bypass lines to regulate the level of the water in the No. 4 heaters. The level in the condenser hotwell is maintained constant by a level controller on the hotwell and by controlling diaphragm valves in the hotwell pump discharge lines.

Extraction Steam Piping

All extraction pressures and temperatures are within the allowable temperature range for carbon steel pipe. Consequently, pipe conforms to ASTM specification A106, grade B, with no chrome or moly used. The line to No. 1 heater is schedule 80 and all lines for lower pressures are schedule 40.

Cast steel valves with stainless steel trim were welded into the line to eliminate joints wherever possible. The result is that the only flanged joints in the lines are at the Nos. 1 through 4 heater shells. The lines to the low pressure heaters inside the

The whole system is valved in such a manner that any unit can be segregated for repairs and maintenance

condenser neck were welded throughout to preclude the possibility of a shutdown due to a blown gasket.

Positive closing check valves are in all extraction lines to heaters having sufficient volume to overspeed the turbine in cases of loss of load. Ordinary swing check valves are in the other extraction lines where recommended by the turbine manufacturer.

The shutoff valves at heaters Nos. 1 through 4 are motor operated and tied into the control system so they will be closed automatically in case of an abnormally high level in the heaters.

Since all extraction lines are subject to pressures less than atmospheric during startup, valved drain lines are installed to drain the lines to the condenser until the pressure in the lines is sufficiently high to operate the normal trapped drain lines.

Flexibility is provided by bends, where possible, and offsets in the piping between the turbines and heaters, except where corrugated stainless steel, unguided expansion joints are used inside the condenser neck.

Drains, Vents, and Blowdown

The heater drain system was designed to cascade the drains from any particular heater to a heater of lower pressure, through diaphragm control valves, where possible. Due to low pressures in some of the low pressure heaters, it is necessary to pump these drains forward into the condensate system.

The drain lines between the heater outlets and the diaphragm control valves were designed for very low velocities to prevent flashing and erosion of the piping system. Piping on the discharge side of the control valves is as short and direct as possible. In most cases, the control valve is directly over the heater opening into which the drains are discharged. All piping is seamless steel, conforming to ASTM specification A106, grade B. The gate valves are cast or forged steel with stainless steel trim and welded into the line.

Diaphragm control valves for controlling heater drain flows are 4 to 6 percent chrome steel body with stainless steel seats and trim for all pressures 150 psig and above, and for all temperatures 411 F and above. Control valves for lower pressures and/or temperatures are cast steel body with stainless steel seat and trim. All control valves are flanged and arranged to close on loss of the operating medium. They were designed for a maximum flow of approximately 10 percent in excess of the maximum calculated flow. The valves are controlled pneumatically from torque tube type controllers on the heater shells or drain tanks.

All control valves in the heater drain system are bypassed with hand operated V-port globe valves of approximately the same size as the control valve port.

All steam safety valves are equipped with vents to carry the steam 6 ft above the roof of the plant. In some cases, this necessitated rather long lines. These vents were designed in accordance with a method of applying the acoustic velocity principle to flow inside the vent pipe, proposed by Max W. Benjamin in his article in the October 1941 HPAC. In all cases, the vents have operated without objectionable blowback.

High pressure heaters and evaporators are vented to the No. 4 heater, which in turn is vented to the atmosphere through the vent condenser, thus conserving heat and releasing a minimum of vapor into the building. The low pressure heaters are vented to the turbine steam condenser. The piping is welded throughout, using socket welding fittings, except that connections to heater shells are flanged. Valves are forged steel with socket welding ends. Those used for throttling are of the V-port type.

Raw Service Water System

Strained raw river water is used for cooling turbine oil, hydrogen in the generators, bearings, fluid drives, transformer fire protection and other services.

From the six 2400 gpm pumps, which take their suction from the condenser water intake conduits, a piping system is provided throughout the powerhouse, consisting of a horizontal loop header above the basement floor and a vertical loop header up through the heater bay, terminating in six 6500 gal tanks on the roof. From these loop headers branch lines are taken off for cooling water service and other services. Outlets 1 in. in diameter are installed at strategic locations throughout the plant so that no more than 50 ft of hose is needed for any normal use.

The piping system is standard weight steel pipe with welding fittings for the larger sizes and screwed malleable iron for the smaller sizes. Valves 2½ in. and larger are cast iron flanged body with bronze trim, and small valves are bronze.

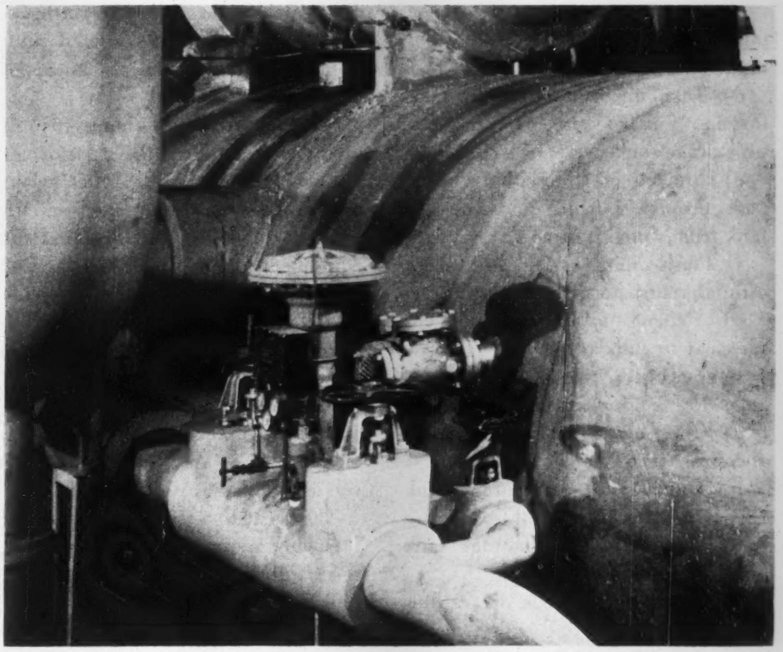
The whole system is valved in such a manner that any unit can be segregated for repairs and maintenance or changes to the system at any time a particular unit is shut down. The water level in the storage tanks on the roof is maintained by double acting altitude valves and is indicated by gages on the top floor of the powerhouse.

Due to wide variations in water temperature from summer to winter, pressure switches may start and stop two of the raw water pumps automatically to conserve power and thereby relieve the operators of that responsibility. In addition, there are control switches in the unit control rooms for all six pumps.

The power transformers adjacent to the turbine room wall are provided with permanent piping and atomizing spray nozzles arranged to completely blanket the transformer in case of fire in the transformer. The water for this system is supplied from the horizontal loop header in the powerhouse through solenoid operated diaphragm valves. Normally, the system is dry, and the solenoid can be energized in one of three ways; namely, (1) manual control switches, (2) thermostats located at strategic spots in the transformer and (3) generator differential relays.

Compressed Air Systems

Two compressed air systems are provided in the powerhouse, one for general plant service and one for instrumentation. The system for general plant service has three conventional oil lubricated compressors, each rated at 660 cfm at 100 psig. A fourth machine of the same capacity is provided in the yard utility building and cross connected with the powerhouse system so that either system can be made to supplement the other. Three 290 cu ft air receivers reduce cycling of the compressors and pressure variations on the system.



DRAIN LINE PIPING between the heater outlets and the control valves is short and designed for low velocities to prevent flashing

The piping system consists of a horizontal loop header above the basement floor with branch lines and 1 in. service outlets at strategic locations throughout the powerhouse.

The system for instrumentation is served by three nonlubricated carbon ring compressors. Two of these machines are rated 440 cfm each at 100 psig, and one is rated 640 cfm at 100 psig. Three 290 cu ft air receivers are also used in this system.

From the air receivers, a steel pipe line supplies air to three filter stations in the three unit control rooms. Brass pipe and copper tubing is used for the distribution system after the filters to prevent pickup of scale which would foul the small orifices in the control instruments.

Oil Storage and Transfer

Facilities for storing, purifying, and transferring three kinds of oil are provided in the plant:

a) Turbine lubricating oil.

b) Insulating oil for transformers and circuit breakers.

c) Light distillate fuel oil for igniting the pulverized coal burners in the boilers.

The storage and transfer systems consist of storage tanks, transfer pumps, purifiers for lubricating and insulating oil and piping systems from storage to point of use.

For lubricating oil, one dirty oil tank and one clean oil tank, each having a capacity of 4150 gal, are provided in a fireproof room in one end of an intermediate floor between the turbine room and basement floor. The purifier and clean oil transfer pumps are in another fireproof room adjacent to the storage room. The dirty oil transfer pumps are on the basement floor near the turbine oil tanks. The piping system provides for the following operating possibilities:

a) Fill either storage tank from railroad tank car or tank truck using clean oil transfer pump.

b) Pump oil from turbine oil tank to either storage tank, using dirty oil pump near turbine oil tank.

c) Transfer clean oil from storage tank to any turbine oil tank using clean oil pump.

d) Take oil from dirty oil tank through purifier and put in clean oil storage tank.

e) Circulate oil from either storage tank through purifier and back to tank from which it came.

f) Flush piping system with clean oil and return to dirty oil tank.

g) Remove oil from system to tank car or tank truck.

For electrical insulating oil, the following equipment is installed:

a) One 12,500 gal storage tank for clean oil.

b) One 12,500 gal storage tank for dirty transformer oil.

c) One 12,500 gal storage tank for dirty circuit breaker oil.

d) One 200 gpm clean oil transfer pump.

e) One 200 gpm dirty oil transfer pump.

f) One oil purifier with a capacity of 1200 gph without the filter press.

g) A piping system from the storage tanks to the point of use.

The storage tanks for insulating oil are underground at one end of the turbine room and adjacent to the railroad track serving the turbine room. The method of supporting the tanks differs from common practice in that each tank is supported at only four points by lugs welded near the tank head. The lugs are on independent piers and are anchored to the piers to prevent flotation. Before the tank pit was backfilled, the tanks were coated with bitumastic paint to a thickness of not less than 1/32 in.

An underground piping system is provided throughout the transformer and switch yards with outlet valves near each transformer and circuit breaker for filling and draining the equipment. Flexible oil hose is used for connecting the header system to the fill and drain valves on the equipment. The underground piping is wrought iron, 6 and 4 in. in diameter, welded and provided with expansion joints where required. Main sectionalizing valves are plug type, while service outlets are gate valves.

The system was designed for the following operating possibilities:

a) Fill dirty oil tanks from either tank car or tank truck.

b) Purify oil from either dirty oil tank and transfer to clean oil tank using pumps on the purifier.

c) Fill transformers or oil circuit breakers from clean oil tank using clean oil transfer pump.

d) Drain transformers or oil circuit breakers into the appropriate dirty oil tank using the dirty oil transfer pump.

e) Remove dirty oil from system using dirty oil transfer pump.

f) Remove clean oil from system using clean oil transfer pump.

g) Drain and fill electrical equipment in service area on the turbine room floor using appropriate oil transfer pump.

h) Flush piping system with clean oil and return to dirty oil tank.

i) Purify oil in transformers or circuit breakers by circulating oil through purifier without removing equipment from service.

j) Purify oil in clean oil tank by circulating through purifier.

Four 12,500 gal tanks, three 25 gpm pumps, and a piping system are available for storage and handling of light distillate fuel oil for igniting the pulverized coal burners. The fuel oil storage tanks are underground in the same manner as described above. The pumps are in a separate fireproof room inside the plant, and the piping system is welded throughout using steel valves and welding fittings.

Since a constant pressure is required at the burner when operating, a diaphragm type back pressure valve is installed at each unit between the oil supply and return lines to maintain a constant pressure.

The system was designed for the following operating possibilities:

a) Fill any tank from tank car or tank truck.

b) Supply sufficient oil to ignite half the units in the plant simultaneously.

c) Drain any tank into other tanks.

d) Remove all oil from the system.

All underground piping in the above systems was coated with hot asphalt, spirally wrapped with burlap, after which a second coat of hot asphalt was applied.

Scientific Color Selection Beats the Heat

COLOR IS ONE of nature's air conditioning gifts, according to findings of the Color Research Laboratories of Sun Chemical Corp. Recent tests show that color staves off the discomforts of heat and can actually be used to control temperature in storage areas and packaging.

Around the basic premise that dark colors absorb heat rays while light colors reflect them, researchers have created a body of knowledge now used to diminish the effects of summer temperatures on people, foods, and chemicals.

For example, the hold of a white ship in the tropics may be at least 10 F cooler than the hold of a black ship. The U.S. Bureau of Mines reports that in a period of four and one half months, a white tank had an evaporation loss of 1.4 percent while a neighboring red tank suffered a loss of 3.54 percent—more than double.

In one of their specialties—printing inks—Color Research reports findings of particular interest to grocers, warehousemen and housewives. Food packages in light tints—especially orange and green—reduce spoilage by absorbing ultraviolet rays which, studies show, cause the worst damage. Similarly, light colored packages remain cooler to the touch than dark ones and their contents are less likely to melt.

ASRE Convention Highlights

. . . summarized for quick reading

By J. E. Salmon
Carrier Corp.

FINAL ACTION on the proposed name change of the 50 year old ASRE to the American Society of Refrigerating and Air Conditioning Engineers, presented to the summer convention in Seattle, is expected to be taken at the society's winter meeting in Philadelphia.

Also, the society recently established a joint committee with the ASHVE to seek closer cooperation of the two societies and to prevent overlapping of their fields of interest. Members of this committee for the ASRE are Chairman F. H. Faust, C. F. Kayan, James Larkin, J. F. Stone and N. N. Wolpert; and for the ASHVE, M. F. Blankin, P. B. Gordon, John Haines, Vice Chairman E. N. McDonnell, and Prof. E. R. Queer. Secretary of the committee is M. C. Turpin, executive secretary of the ASRE.

Technical Session Highlights

A full program of technical sessions was held each day. Topics included air conditioning, refrigeration and insulation.

Air conditioning by high velocity air distribution was the subject of one session. While admitting that this system was not necessarily a "cure all" or application for all installations, F. Honerkamp, of the Anemostat Corp. of America, pointed out its possibilities of cost savings. The savings, he says, are chiefly in weight and space requirements for the duct system, and the possibility of reducing overall system size through the use of higher outlet temperature differentials, with smaller primary air quantities distributed.

In a session on insulation, J. D. Verschoor, of the Johns Manville research center, described investigations of the thermal conductivity of 12 commercial insulating materials at very low temperature—down to −200 F—in which was used a modification of the Wilkes calorimeter with liquid oxygen as a refrigerating medium.

Following this, the application of the heat flow meter for field use in existing structures was described by Professor J. T. Gier, of the University of California.

Freight Car Refrigeration

In a session on mechanically refrigerated freight cars, D. C. McCoy, of the Frigidaire Division of General Motors, declared that these freight cars are now practical. A diametrically opposed view of their possible general use was taken by K. V. Plummer, of the Pacific Fruit Express Co. "This is strictly from the economic viewpoint," he said. "The vast sums of money now invested in icing stations, handling equipment, ice plants, and the present bunker type ice cars cannot be written off without a tremendous loss to the owners."

Also on this subject, John Daley, of the Santa Fe railroad, which now has 30 mechanically refrigerated cars in operation, supported the view that the major field for this type of car is frozen foods. However, he also feels that the use of the same cars, or similar cars, for higher temperature loads should be economically possible.

This session was concluded with a paper on the vacuum pre-cooling of market produce by Dean H. P. Hayes, of California State Polytechnic College.

At one technical session were presented new charts and tabulations which simplify the determination of pressure drop for "Freon 12" and "Freon 22" through the complete refrigerating circuit, including the evaporator itself as well as the suction, discharge and liquid lines. With these charts, the design engineer can more accurately determine his working pressure losses in any given system, and hence do a better job in piping and system design.

Concurrent with the various technical sessions were two engineering conferences, one on domestic refrigeration and another on room air conditioners. At the room air conditioner conference, H. L. Laube, of the Remington Corp., referring to the room air conditioner industry, contrasted the present state of "our adolescent major industry" with its "embryonic" state at the first conference five years ago.

Round Tables Popular Feature

A new feature tried at this year's convention was the round table discussions, so popular that six forums of this type are slated for the next meeting. Each forum, informal and non-recorded, was begun with a panel of experts to lead off the discussion, followed by general participation. Topics included oil problems with "Freon 22," refrigeration problems in the meat packing industry, capillary tubes versus expansion valves on commercial self contained air conditioners, and new thinking on short form cooling load calculations.

CORNER STRUCTURE, known as the 1001 Connecticut Avenue building, is one of Washington's newest office buildings. Adjacent building at the right has two 70 hp generators that burn No. 6 oil.

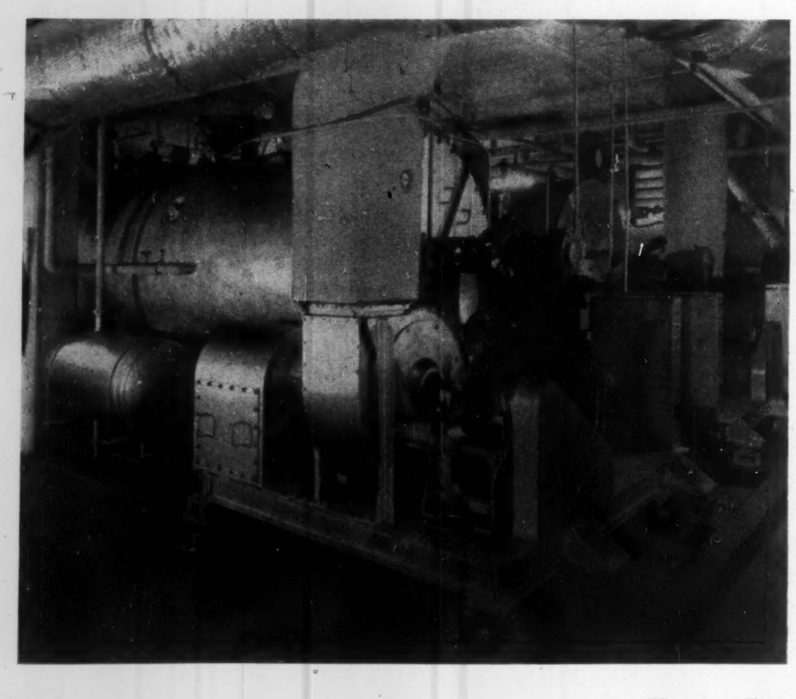
• In the construction of this new office building, the entire heating and air conditioning equipment was placed on the roof. Reported here are the details of the installation and the results of the first year's operation.

Also, the author describes in the second part of the article the conversion of an apartment heating system to unit steam generators.

Heating

By D. B. Tuxhorn

L. P. Steuart Co.



INSTALLATION OF TWO 150 hp unit steam generators in penthouse atop 1001 Connecticut Avenue. Each burns No. 5 fuel oil. Mounted on vibration eliminators, they occasion no problem to rental space below.

THESE FOUR APARTMENT houses, built in 1929, were converted to fuel oil burning unit steam generators in 1953

Costs Reduced

. . . in two installations

OFFICE BUILDING

1 When the 12 story 1001 Connecticut Avenue building was erected in Washington, D. C., less than two years ago, two 150 hp unit steam generators were installed on the roof. Architect Edwin Weihe and the consulting engineers, General Engineering Associates, had collaborated on the idea of placing the complete heating and air conditioning equipment on the roof and a restaurant in the basement.

In the first year's operation under full occupancy of the building, the two generator units, specifically designed for fuel oil, consumed less than half the number of gallons required by standard boilers which had been installed in the basement of another new Washington building of comparable cubic size.

Both buildings, nearly identical in size and construction, are fully air conditioned and ventilated. The other, built two years before the Connecticut Avenue building, is equipped with standard SBI three pass compact fire boilers and a standard make horizontal rotary oil burner. These boilers are connected to a normal stack and equipped with a barometric draft regulator.

Why Big Fuel Differential?

Two factors might account for some of the difference in fuel consumption. The Connecticut Avenue building, with an adjoining building on one wall and adjoinment for five stories on a second wall, is slightly less exposed than the other, which has an adjoining building on only one wall. Also, the other building requires a slightly larger supply of 140 F domestic water for a restaurant somewhat larger than the one in the Connecticut Avenue building.

However, these incidentals do not account for the tremendous difference—over 100 percent—in oil consumption. The difference, the operating engineer feels, is due largely to three main reasons:

1) Greater thermal efficiency of the unit steam generators as compared to the standard SBI boilers, which

were not originally designed for oil.

2) Greatly lowered standby loss of the unit steam generators, which are of four-pass and down draft construction with restricted openings through induced draft fans when idle, and which are connected to short stub vents through the boiler room roof. In contrast, the standard up draft SBI boilers, connected to 100 ft or more of stack, draw cold air in large quantities through the boiler when idle.

3) Ability of the mechanical draft steam generator to maintain clean fire surfaces because of the rapidity of flue gas travel.

Roof Installation Advantages

Saving on the cost of fuel is only one of the advantages the management has found. By centralizing the air conditioning equipment as well as the boilers in the penthouse, operating engineers have found their job greatly simplified. And the elimination of costly stack construction, in addition to the initial saving, allows increased rental space which would have been occupied by a stack. Also, because of the building's downtown location, the basement is better utilized for restaurant space.

The fuel oil tank is outside under the sidewalk. Fuel oil transfer pumps in the basement circulate an excess of oil up to the boiler room and back to the tank. The pumps are electrically connected to the automatic oil burners and operate only when the burners are on.

APARTMENT BUILDINGS

2

In ANOTHER installation, modernization of a group of four Washington apartment buildings included a complete conversion of the heating system to two 200 hp unit steam generators burning No. 6 fuel oil.

For these buildings, five stories tall and located on a gradually sloping elevation, domestic hot water as well as the steam for heating was supplied by four cast iron sectional boilers.

New ownership of the apartment buildings converted the system to heavy fuel oil in 1953.

Only Slight Structural Change

The only structural changes necessary for the installation of the two 200 hp unit steam generators chosen was the lowering of the boiler room floor about 3½ ft in the second highest elevation building. In this boiler room, an existing stack—26 x 26 in. inside dimension—which extended the full height of the five story building, was estimated to be adequate for these induced draft boiler-burner units. The domestic water supply was to be obtained from tankless heater piping below the boiler water line and interconnected so that it could be used with either boiler.

With the boilers in this building, return from this and the adjacent higher elevation building is effected by gravity. The condensate from the two lower buildings is connected into a pump and tank set located in the lowest building and pumped from there to the boiler room.

Between the buildings, three underground trenches, 30 to 40 ft in length, contain the one pipe system of steam and return mains, insulated with magnesia and jacketed with bituminous compound. The domestic hot water lines are of copper, covered with magnesia.

The gravity return from the two buildings and the return pumped from the collector tank in the lowest building is collected in the boiler room in a 600 gal accumulator tank, equipped with a small automatic water feeder located to feed water at about 12 in. from the bottom of the tank. Each boiler has a water level pump control switch which actuates a small centrifugal boiler feed pump for each boiler.

Steam to Mains at No Pressure

Because of the length of the steam mains, a total of 22 float and thermostatic traps, 1¼ in. to 2 in. in size, are installed at all ends to vent these traps to the basement atmosphere. In this manner, as nearly as possible, all mains fill with steam at virtually no pressure until the thermostatic elements in these traps close, starting to build pressure and sending steam up the risers to the radiators. Several variable port radiator vents are also installed, more of which will be installed as replacements of the old ones are needed.

Temperatures in the buildings are controlled by one clock type thermostat on the north wall of the boiler room building, set to start the burners at 5:30 a.m. and cut them off at 11 p.m. Below the water line, aquastats keep water in both boilers at 180 F at all times.

Existing Stack Deciding Factor

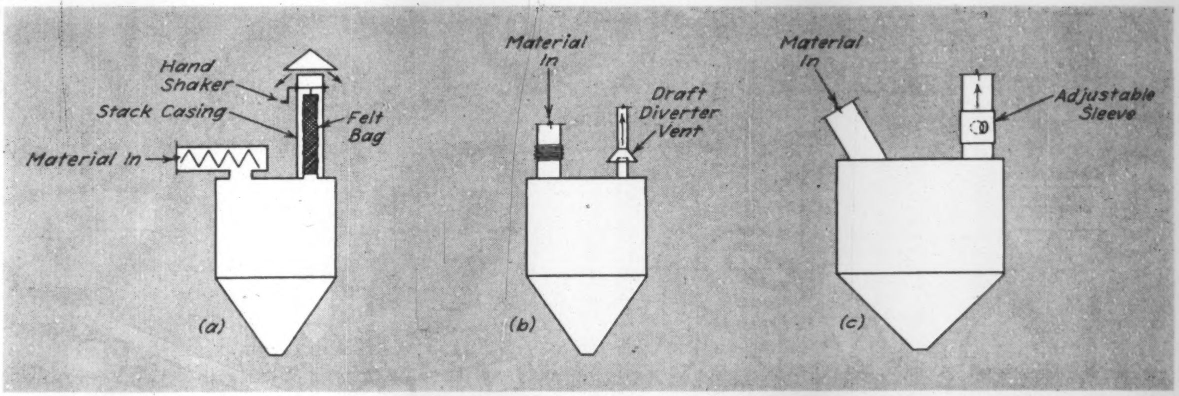
One very important feature in the selection of this equipment was the decision to utilize the existing stack. With the mechanical draft unit steam generator, the stack, which had been large enough to handle only one fourth of the original system on natural draft, was sufficient as a vent for both of the new boilers.

An alternate proposal involving the use of conventional natural draft boilers was found infeasible from either a construction or economical standpoint, since it would have required construction of a new and costly stack large enough to handle the boiler hp load efficiently. In addition to the preclusive cost of erecting this extra stack, the plan met with the extreme difficulty of obtaining head room for the boilers without involving interference with the existing construction of the building.

In operation since October 1953, this plant used 131,255 gal of fuel oil the first year, at an average of 6.6 cents per gal, or an annual fuel cost of $8750. The management expects the entire installation to pay for itself in four or five years of operation, depending upon possible variation in the price of fuel.

The total volume of the four buildings is 2,421,682 cu ft. There are 238 apartments. The owners therefore enjoy a very low unit operating cost.

(Photos courtesy Preferred Utilities Mfg. Co.)



1 THREE UNUSUAL TYPES of exhaust hooding to prevent the contaminant from escaping are shown here.

a) THE HOPPER VENT dust filter has a large dust collector breather bag suspended vertically in the outlet which acts as a final eliminator.

b) THE FLOATING or weigh hopper has a draft diverter vent which is suspended over and around the top of the vent, without contact.

c) THE STATIONARY SURGE hopper has a rigid duct with a side port hole and sliding sleeve which permits the application of any draft as needed.

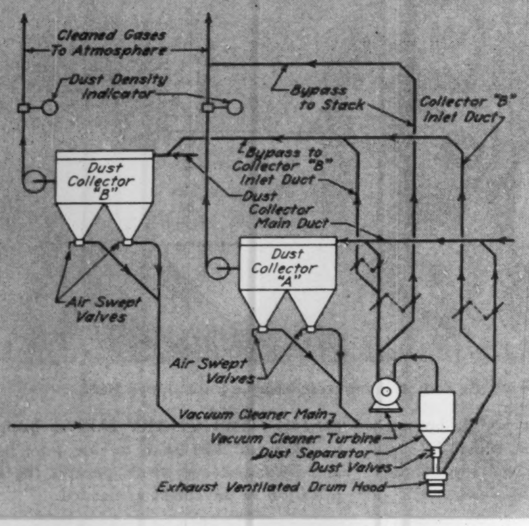
Controlling Uranium Dust

. . . Unusual methods meet unusual problems in ventilation and health protection

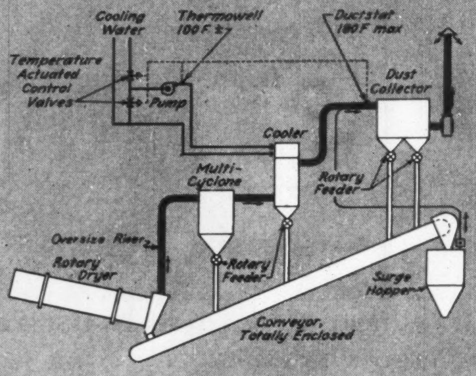
By H. I. Miller, Jr.
Senior Project Engineer
Catalytic Construction Co.

• Solutions to some of the problems in designing heating, ventilating, and dust control facilities for health protection in a large uranium producing plant operated for the Atomic Energy Commission are presented here. The purpose of this article is to indicate the application of standard equipment and methods to the control of dust and atmospheric pollution in an unusual process where an especially high degree of control is necessary.

THE METALLURGICAL processing of most ores and concentrates is attended by the presence of noxious or nuisance dusts and gases that must be controlled to varying degrees depending on the toxicity of materials encountered. The refining of uranium ores and concentrates into the metal is typical in a general way, involving heavy metal dust, hydrogen fluoride and oxides of nitrogen. To these are added the unusual categories of radioactivity of radium during the early stages of the refining process and radioactivity of the uranium and its daughter products throughout. Operations involving these elements call for control of air pollution, both within and outside of the operations area, to an unusually high degree. Fortunately, standard ventilation and dust control equipment can be adapted to the purpose.


Cleaned Gases
To Atmosphere
Dust Density
Indicator
Bypass
to Stack
Collector "B"
Inlet Duct
Dust
Collector
"B"
Bypass to
Collector "B"
Inlet Duct
Dust
Collector
Main Duct
Dust
Collector
"A"
Air Swept
Valves
Air Swept
Valves
Vacuum Cleaner Main
Vacuum Cleaner Turbine
Dust Separator
Dust Valves
Exhaust Ventilated Drum Hood

2 DUST COLLECTOR UNLOADING by fixed vacuum cleaner system. All dust caught in several collectors can be transported to one point where the material can be placed in drums and returned to process.


Cooling
Water
Thermowell
100 F ±
Ductstat
180 F max
Temperature
Actuated
Control
Valves
Pump
Dust
Collector
Cooler
Multi-
Cyclone
Rotary
Feeder
Oversize Riser
Rotary
Dryer
Rotary
Feeder
Surge
Hopper
Conveyor,
Totally Enclosed

3 THIS FLOW DIAGRAM shows the dust collection and dryer system. Among the special problems involved in this process are the cooling of gases, prevention of condensation and minimization of dust adherence to cold surfaces.

Design Criteria Cited

Design criteria called for maintaining an operations atmospheric pollution level for radioactive dust not to exceed 70 disintegrations per min per cu meter of air — which for uranium is equivalent to 50 micrograms per cu meter. This figure served for dust control of uranium and any dusts associated with it, including pitchblende dust with its radium content.

Uranium is an alpha-ray emitter. Direct radiation from it is unimportant, being stopped by almost any barrier, including the normal skin. However, inhaled or ingested into the body where it attains close proximity to tissue it can do serious harm. Uranium slowly breaks down into daughter products, UX_1 and UX_2 which are beta-ray emitters. The beta rays encountered in this process are readily stopped by thin glass or metal so that a hood or hopper may provide ample protection from radiation.

The radium in the pitchblende ore and in the process rejects is a gamma ray source and constitutes the most serious direct radiation hazard in the process. Design criteria called for a maximum weekly exposure of 300 mr of gamma radiation. Actual design was predicated on a tolerance of half this amount to allow for inevitable short periods of high level exposure by operators subject to unusual duties. Radium is always accompanied by its daughter product, radon gas, for which the design criteria limit was 10^{-8} curies per cu meter of air — or approximately 7×10^{-12} parts per million.

Integration of Design

The engineer group handling the industrial hygiene phases also bore the responsibility for radiation protection and for the general heating and ventilating of buildings, in order to coordinate effectively all these interrelated functions. This group of specialist engineers produced a completely integrated design to satisfy the requirements for process, health and comfort limitations in the working environment. This group also designed:

1) a medical dispensary completely equipped to do X-ray work and minor surgery,

2) a "health physics" laboratory, with instrument repair and calibration facilities, machine shop, dark room and chemical laboratory, with associated equipment, and

3) a decontamination room, furnished with fixed and portable equipment suitable for treatment of surfaces contaminated with radioactive materials. Even a repair shop for contaminated shoes was set up in this room.

These features, along with specifications covering issue clothing and shoes, were done in consultation with medical and health specialists of the Atomic Energy Commission and its operating contractors, who made available their wealth of experience.

The design approach for ventilation and dust control differed mainly by degree from usual industrial hygiene methods. They had to be adapted, as necessity dictated, to the interposing of radiation barriers and remote control. The methods are:

1) isolation of process,

2) application of local and/or general exhaust ventilation,

3) highly efficient filtration of solids from collected air, and neutralization of acid vapors where appropriate,

4) Dispersion of effluent gases by discharge through high stacks,

5) provision of adequate tempered make-up air to replace that exhausted, and

6) wet handling.

Isolation of Process

The value of the materials, as well as their toxicity, required that special effort be made to utilize tightly enclosed equipment, such as elevators, conveyors, blenders and batch dumping equipment. Theoretically, these can be maintained dust tight, but actually, poor maintenance must always be presumed. Where there is any possibility of dusting out, local exhaust ventilation must be applied to the enclosure. In fairly tight systems there arise the problems of air quantities and the maintaining of conveying velocities for dust laden air under varying circumstances. These matters are discussed later under the subject of exhaust ventilation.

The major point to be emphasized in this connection is the importance of keeping process materials within the process stream and thereby minimizing the health and economic problems of rehandling that portion collected as dust.

An example of a process not amenable to control by closely applied cover or exhaust ventilation was the weighing and deheading of drums of pitchblende. These operations had to be walled off because of gamma radioactivity, and incidence of radon and dust. For protection of plant employees, these operations were established in a closed ventilated room utilizing remotely operated equipment. It was expedient further to isolate the operator in a concrete walled room that projected into the processing area. The concrete walls and a lead glass window provided for his complete protection from radiation effects.

Since the handling of hydrogen fluoride is obviously a dangerous operation, where it was necessary to do so indoors, the bulk of the equipment was isolated in a walled off area of the building and provided with continuous supply and exhaust ventilation at about 15 air changes per hr. Emergency ventilation fans were furnished that would move up to about 60 air changes per hr and these were linked with automatic dampers in the exterior walls which would open when the fans operated, insuring adequate inflow of air to the space.

Exhaust Ventilation

Both local and general exhaust ventilation were employed wherever needed throughout the project. Dust control claimed the major portion of all the design work done on the industrial health aspects, embracing a variety of processes in several buildings. Self balancing systems were designed such that at the desired rates of flow the total pressures at main and branch junction points were calculated to be identical, making dampering normally unnecessary.[1]

Dust collecting and other air handling equipment had to be ordered early in the design period to insure delivery on time. This meant estimating collecting requirements before the process equipment was fully known. Then, after the process design was firm, however changed, it meant recalculating the local exhaust systems to:

1) give the desired control,

2) be self-cleaning,

3) be self-balancing, and

4) be adaptable to the collectors purchased.

Air quantities for local exhaust ventilation were determined by the needed inflow through actual and anticipated openings to prevent the contaminant from escaping. Volumes and entrance losses for the unusual types of hooding were readily determined. However, for tightly closed vessels receiving dry materials, venting for egress or ingress of air had to be provided. Also, for reasonably tight systems some provisions had to be made for inspection ports which might be left open or panels not tight. Three measures were employed (see Fig. 1).

1) Where a vessel was perfectly tight and was to fill or empty at a steady rate, a breather bag of large size was suspended vertically, the top end closed and the lower end tied over a short vent pipe on the vessel. Usually a dust collector bag was used. No exhaust ventilation was applied.

2) For tight weigh vessels, not tolerating a breather bag, a conical or bell-shaped exhaust system inlet was located over and around the top of the vent, but not touching it. (This is an adaptation of a draft diverter stack connection. The required velocity of air for dust carrying is maintained in the exhaust branch without physical connection or undue draft on the vessel, yet any escaping dust is captured.)

3) For fixed vessels or reasonably tightly enclosed systems, a rigid duct connection was made. A port was cut into the side of the duct close to the connection and a sliding sleeve installed to permit covering as much of the port as necessary for control. This device permits application of draft to the vessel or system exactly as needed and allows sufficient bypass air through the port to maintain carrying velocity.

Powered roof ventilators were widely employed for general ventilation for the removal of heated air generated by process or summer sun. A temperature rise of 5 F over ambient was usually taken as permissible for calculating volumes to be removed.

Pitchblende Thawhouse Exhaust

An exhaust system of some interest was that provided in a pitchblende thawhouse for removal of radon. A thawhouse is a necessity in winter for treatment of frozen drums of ore prior to processing. Enormous quantities of heated air would be needed for the combined requirements of radon removal and thawing under ordinary circumstances. Using the isolation principle, the thawhouse was made up as a tight box, the drums of pitchblende traversing it on powered conveyors between steam heated plate coils. Inlet and outlet doors are self-closing, counter balanced and open only for introducing or releasing drums. An exhauster, discharging to a high stack, operates continuously. It can draw little air except when a thawhouse inlet or outlet door is opened, and even then it is dampered to about half capacity.

---

[1] All references mentioned in this article are listed at the end.

Should access by personnel be necessary, either or both of two large purge doors in the sides of the thawhouse can be opened, whereupon the exhauster damper will automatically open wide and the chamber is purged of the heated, highly radon-contaminated gases. Blocking open the end doors hastens the purging. Following the emergency, shutting the purge doors causes the fan to be dampered as before. Since the radiation hazard is serious in this building, operators having to enter can stay only a limited time.

It is also well to mention that a piercing device was placed at each inlet door for perforating heads of drums prior to their introduction. By this means, any dangerous steam pressure buildup in the drums during thawing is averted.

Bag Type Dry Filtration

The choice of air filtration equipment for uranium dust and associated materials was the reverse jet, suspended bag type collector.[2] Cost, adequacy of filtration, commercial availability, practicability for maintenance, and successful experience in similar operations were all important considerations.

Although not subjected to the heavy loadings for which this type collector was designed, it had been found to give better than 99 percent recovery at fractional grain loadings of comparable dust. An optimum filtration rate of 10 to 11 cfm per sq ft of filter cloth was determined on an efficiency - horsepower - maintenance basis. Fifteen cfm per sq ft was the design maximum.

The bags employed were a special resin treated wool felt, and ranged from 9 to 18 in. in diameter. Their top operating temperature was limited to 180 F. Calendered orlon bags, which have become available recently and which were furnished to the project on an experimental basis, show much promise in regard to acid and alkali resistance, high temperature (275 F) and wear.

Fixed vacuum cleaner systems were established for cleanup work, and in some instances to provide or supplement local exhaust ventilation.[3] The effluent air from these, having been filtered in cotton bags, is directed to reverse jet bag type collectors for cleanup. The vacuum cleaner systems in many instances also provided dust collector unloading facilities as shown in Fig. 2. Those collectors so served were fitted at bottoms of hoppers with a unique air swept valve connected to the vacuum system.

All dust caught in several collectors can be transported to one locality where the material can be placed in drums and returned to the process.

The dust collectors are thoroughly instrumented. Each stack is monitored by a photoelectric haze detector with an alarm to warn of leaking or broken bags. To reduce wear on bags and to maintain a high filtration efficiency, blow ring operation is controlled by differential pressure across the bags, usually being placed in operation at 4 in. WG and cutting out at 2 in. WG. Each collector has a low differential pressure alarm, normally set at 1 in. WG. This device also detects bags in the system that are broken.

Wet collectors were specified for handling steamy dusty air, utilizing the principle of passing air around an underwater baffle. Provision was made for fiber glass after-filters, should they be required. Electrostatic mist collectors were provided for handling uranium bearing oil mist from machining operations, the cleaned air being returned to the room.

Make-up Air

In buildings having exhaust ventilation, the provision of make-up air is an important factor in the control of toxic dusts or gases.

To prevent rooms or buildings from becoming airbound and to insure the unimpaired functioning of hoods and enclosures connected to exhaust systems, make-up air is carefully distributed, tempered as needed, in amounts equal to or slightly greater than that withdrawn. In most instances, it is further heated to take care of the winter heating requirements of the building.

To conserve steam, the large make-up air units are automatically dampered to recirculate air when exhaust ventilation systems are shut down. Each air unit supplied in this way consists of a standard steam coil and blower set supplemented by a moving frame automatic oil type air filter, and by a damper set and controls that permit outdoor air for make-up and recirculated air for the remainder.

The filter protects the heating coils and keeps dirt out of the distribution system. The oil in the filter is itself cleaned by pumping it through a replaceable cartridge filter similar to that in an automobile oil system.

Supplied air distribution systems follow the usual ASHVE practice.[4] Stainless steel and protective coated steel had to be provided in corrosive areas. Certain recirculating air heating coils are protected by a baked-on protective coating.

Wet Methods Described

The handling of the reject gangue materials with which the radium leaves the process stream offered a potential hazard as:

1) radioactive dust,

2) a source of direct gamma radiation, and

3) a source of radon gas.

The process engineering group worked out a system so that the material is never handled in dry form.

Following digestion of the ore, the insolubles are filtered, washed and the wet filter cake is repulped immediately. The resultant slurry, carrying the radium, is pumped to large covered concrete storage tanks located well away from the operations area. The solids settle out in these tanks and the clear decant liquor is recycled for use again as the repulping medium. The filtration is accomplished in ventilated rooms behind barrier walls.

Special Problems

There were many unusual problems. One wherein processing and health were equally demanding involved the ventilation of a rotary pitchblende dryer. As much as 5 percent of the charge could be carried over in the off gases, which were to be in the vicinity of 400 F and higher at times. Bag filtration was the method of choice, but the allowable bag temperature was limited at the time to 180 F.

To cool the gases, a heat exchanger was procured, having a water tube bundle suspended in an insulated shell through which the gases pass.

To prevent condensation on the tubes — gases could have as high as 130 F dew point — and to minimize dust adherence to cold surfaces, a recycling system for the cooling water was designed to maintain its entrance temperature at about 100 F. A higher temperature gave too little spread for cooling.

To relieve the cooler of the great burden of dust, a multicyclone was provided ahead of the cooler. Both cyclone and cooler were equipped with rotary feeders continually discharging the accumulated dust to a process conveyor.

Finally, the riser from dryer to multicyclone was made as large as practicable to reduce the velocity and the carryover — about 1400 fpm was the lowest attainable. The arrangement is shown in Fig. 3. Such a system is more complex than desirable but, with attention, will pay for itself in values saved many times over.

Testing Prior to Operation

All heating, ventilating and vacuum cleaning systems were subject to rigid performance testing by the construction contractor prior to turnover to the operating contractor. The specifications covered air quantities, balancing, permissible instruments for testing and methods of conducting tests, as well as workmanship and furnishing of specified materials and equipment. Generally, +15 to −5 percent of overall design rating was allowable for dust collector systems, with a ± 10 percent at each inlet for balancing. Supplied air systems, being less complex and being balanced by dampering, were required to be balanced to ± 5 percent.

The work done on this project on heating and ventilating and dust control occupied the efforts of six engineers for about two years and resulted in installations in these categories approximating some $2 million installed cost.

Acknowledgment is made of the considerable assistance afforded by W. B. Harris and his staff of the Health and Safety Laboratory, New York Operations Office, AEC; also that received from K. J. Caplan and Mont G. Mason of the Mallinckrodt Chemical Works, St. Louis, and from R. C. Heatherton and Joseph Quigley, M.D., of the National Lead Co. of Ohio, Cincinnati.

References

1. Principles of Design of Local Exhaust Systems. Industrial Dust, Drinker, Philip, and Hatch, Theodore, McGraw-Hill, 1936. pp. 177-232.
2. Dust Collection Equipment, Chemical Engineer's Handbook, 3rd ed., McGraw-Hill, 1950. p. 1034.
3. Design Factors for Vacuum Cleaning and High Pressure Pneumatic Conveying Systems, Caplan, K. J., and Stephenson, R. L., Heating, Piping & Air Conditioning, October 1952. pp. 131-138.
4. Air Duct Design, ASHVE Guide, American Society of Heating and Ventilating Engineers, published annually.

This paper was presented at the annual meeting of the American Industrial Hygiene Association held recently in Chicago.

New Bus Has Modern Heating, Air Conditioning

. . . also individual vents for smokers

THE FIRST of a fleet of 500 revolutionary new type Scenicruiser buses for the Greyhound Lines rolled off the production line recently at the GMC Truck and Coach Division plant in Pontiac, Mich.

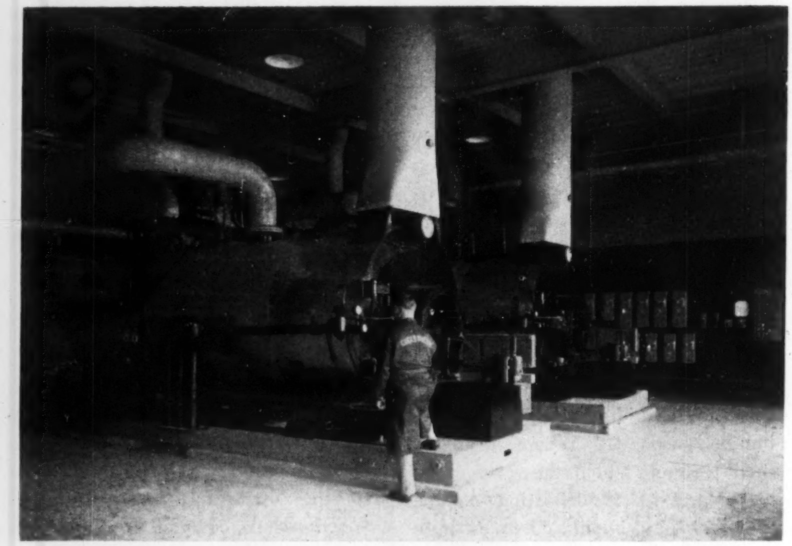
A new development in bus air conditioning is the utilization of structural parts of the body framing and walls as air ducts for radiant heating or for cooling the interior of the coach. The ventilation system is capable of drawing in sufficient outside air to give a complete air change within the bus every 40 seconds. This air is cooled and dehumidified or heated, as required, and circulated in the bus through vents at the window ledges. Further ventilation is made possible by a series of manually operated ports in the window frames. An individually controlled smoke vent above each enables a passenger to smoke without annoying others, because fumes are exhausted immediately.

Greyhound
SCENICRUISER

THIS NEW and modern 43 passenger bus utilizes the structural parts of the body framing and walls as air ducts for radiant heating or for cooling the bus interior.

Low Pressure Steam

• Steam for heating and air conditioning by two absorption refrigerating units, as well as for product processing, in this modern New Jersey plant is furnished by two packaged boilers. Their operation and maintenance are described here



WITH THESE TWO 350 hp boilers, any of the various load combinations can be met by providing low pressure steam in Mennen's new plant.

Two 350 hp package type boilers were chosen to supply steam for heating, air conditioning and product processing in the new Mennen Co. plant at Morristown, N. J. Each of the two units is capable of supplying steam at the rate of 12,075 lb per hr at 212 F. The boilers were built with a design pressure of 15 psig, and the entire system is low pressure, since none of Mennen's processes require high pressure steam.

Wide Variations in Load

Mennen chose two boilers because of the wide variations in load that would be encountered. The load varies from no load on a summer night to one of approximately 350 hp on a peak summer day for air conditioning alone. In addition, the load for manufacturing processes also ranges from no load to 100 hp during a normal day.

With these two boilers, Mennen's operating and maintenance staff can meet any of the various load combinations. Either of the two boilers will carry 75 percent of the maximum load they are likely to encounter in the new plant for air conditioning, plus processing. "So," says George Mennen, who takes an active interest in the plant, "we can get along with one boiler in 99 percent of all our operating ranges."

Oddly enough, because of the absorption system used in the air conditioning plant, Mennen's maximum steam consumption occurs on hot summer days when both process and air conditioning requirements are high.

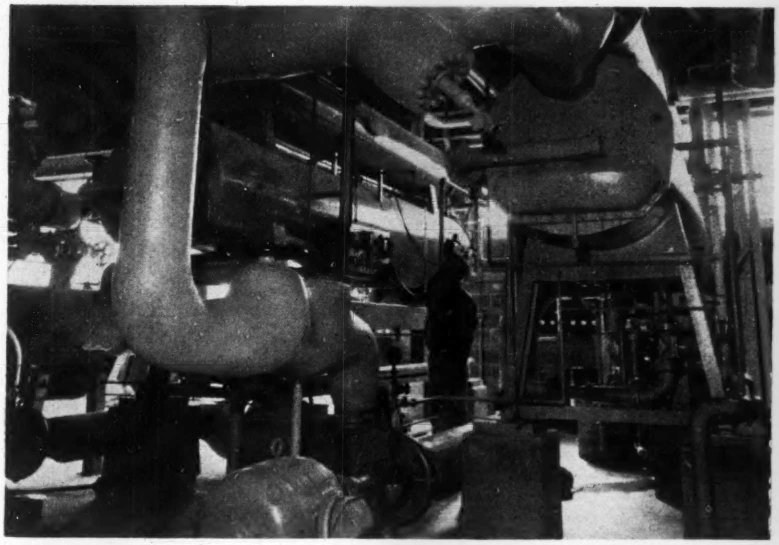
Air Conditioned Plant

The plant is air conditioned wherever there are high concentrations of employees and where the equipment and machines that are operated seem to demand air conditioning. About the only place in the 267,000 sq ft plant that is not air conditioned, however, is the warehouse. Humidity control along with air conditioning is most important in one area of the plant where talcum powders of various kinds are manufactured. There are other areas where air conditioning is similary applied.

The boilers provide 6840 lb per hr of steam to two 180 ton absorption refrigerating units for the air conditioning system. These refrigeration units operate on steam at 12 psig and supply chilled water for all air conditioning requirements to 10 centrally located air handling units and to 130 individual room units.

Seven central system units supply conditioned air to factory areas. Another unit serves the cafeteria, and two others the interior areas of the office space. All of these use chilled water for cooling and dehumidification and steam for heating. The air supply to the plant is cleaned by electrostatic and mechanical filters.

A centrally located air han-



TWO 180 TON absorption refrigerating units cool water for the air conditioning system and use 6840 lb of steam per hr.

Cools, Heats Plant

dling unit takes filtered outdoor air and conditions it by increasing or decreasing the temperature and humidity as desired. The conditioned air is then delivered to the individual room units at a high velocity through small diameter ducts. As it passes through the room units, it induces a flow of room air over the coil in the unit. Chilled water direct from the absorption machine or warm water from a steam converter is circulated through the coil. This gives the occupant of the room individual control of the air temperature, since he may adjust the circulation of water through the coil and consequently the amount of cooling that takes place there. The room units are furred in under the windows around the periphery of the building, and they contain no fans or other moving parts. Induction air from the central system pulls the room air over the coils.

The Mennen plant is an interesting building that presents challenging air control problems because of the wide diversity of uses in the air conditioned portions of the building. There are areas of low density of people in some plant areas and high density areas in offices, the cafeteria, etc. The varying factors are also complicated by the types of equipment in use, as some of them generate heat when the sun load is at its maximum.

The control and balancing of such a system is quite complex. The interior zone units are balanced by both air volume and temperature. At night, the primary air supply is shut off, and the plant goes on a secondary water system.

Diligent Maintenance

Under the watchful eyes of the Mennen maintenance crew, the boilers operate at an efficiency between 85 and 87 percent. Careful and diligent maintenance is undoubtedly one of the main reasons for this relatively high efficiency. The boilers are blown down mornings and evenings, and the burners are removed and cleaned every morning and evening. Every three weeks, the Mennen team opens the boilers to check them, punch the tubes and clean out any soot that may have accumulated. Because these package type boilers take care of themselves at night, there is no boiler operating or maintenance crew on duty at night.

All steam traps are cleaned once every six months and the same is true of the twice a year cleaning of the individual room air conditioning units. Each boiler uses about 100 gal of new make-up water every day.

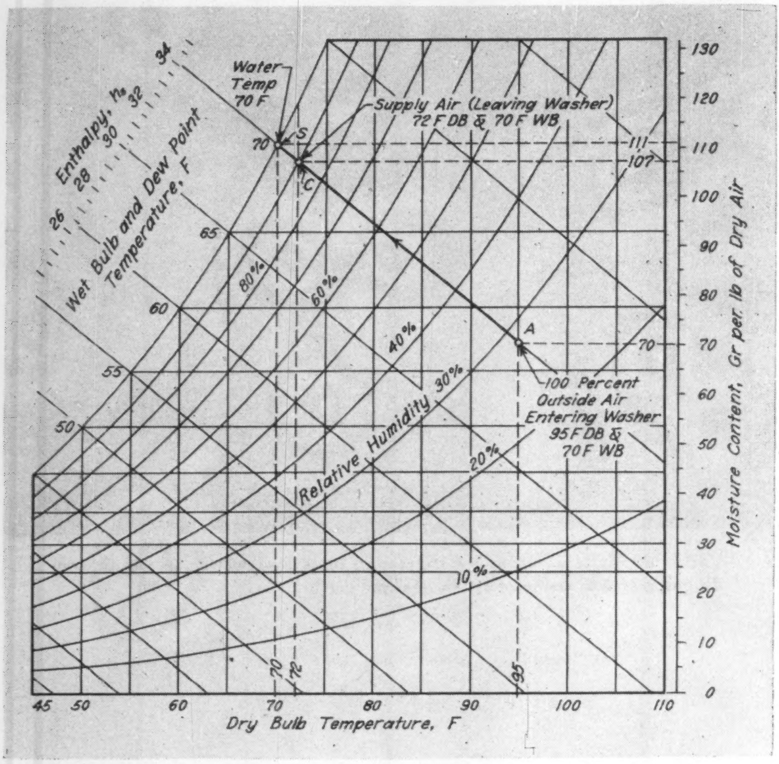
No. 6 Fuel Oil Used

One unusual feature of the installation is that the oil pumps were removed from the boilers and placed against the front wall of the boiler room. Each pump is equipped with the necessary controls so that it will stop automatically in case of breakage of the supply line to the burner. No. 6 fuel oil is used, so the oil pumps have both electric and steam preheaters on the fuel supply line. The electric heater is used for a cold start, and the system is then switched to steam.

Volatile liquids used in manufacturing toiletries are stored in underground tanks on the plant grounds. Liquid ingredients of the various products are piped through meters to control stations. Valves, meters and gages are in the plant so that manufacturing processes can be controlled from one central location. This central control point also simplifies plant maintenance.

A decorative water pool in front of the new building provides water for process cooling and is a secondary source of supply in the event of a fire.

(Photo of boiler installation courtesy of Cyclotherm Div., U.S. Radiator Corp. and the photo of the air conditioning installation courtesy of Carrier Corp.)



1 THE PSYCHROMETRIC analysis for an air washer when used in evaporative cooling with 100 percent outside air is shown here

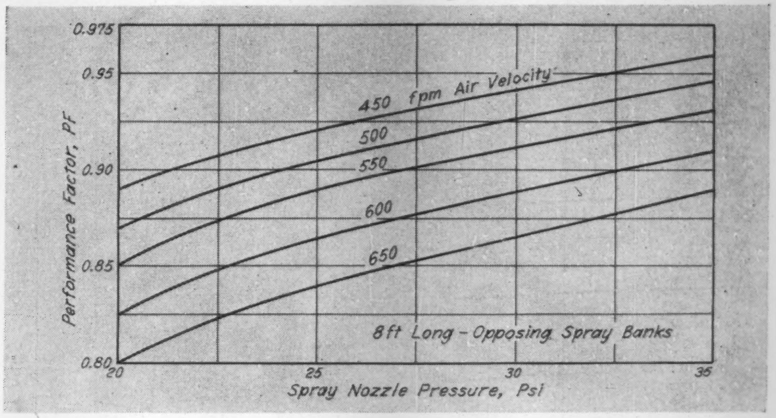
By H. M. Hendrickson

Associate Professor of Mechanical Engineering University of Washington

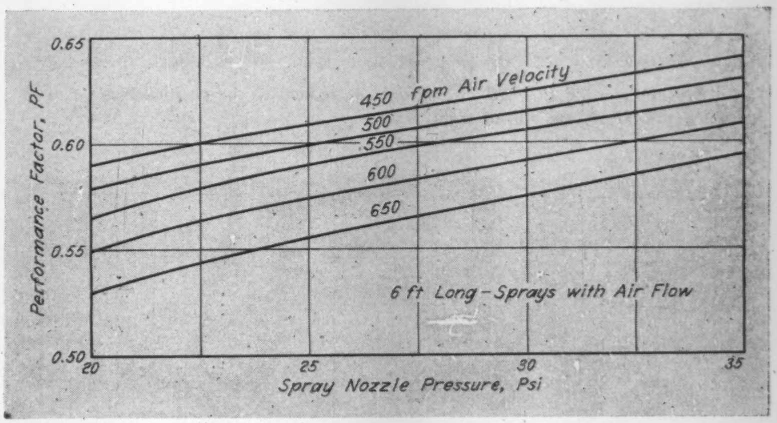
How To Calculate Air Washer Performance When Cooling

• The principles of how air washers perform when cooling, discussed by the author in the March HPAC, are applied here in three practical examples.

By using the psychrometric chart and the water-to-air heat balance, the conditions of the air and water leaving the washer may be estimated if the following design data is available: (1) the saturating efficiency when the spray water is neither heated nor cooled; (2) the performance factor when cooling and dehumidifying; (3) the spray nozzle performance as related to water pressure and orifice size. Related to these factors are air velocity, length of air travel, number of spray banks and direction of water spray.



2 TYPICAL PERFORMANCE characteristics for one manufacturer's two spray bank air washer are shown here



3 PERFORMANCE CHARACTERISTICS for a typical single spray bank air washer are shown by these curves

To ILLUSTRATE the application of air washers when used in evaporative cooling, the following example involves cooling and humidifying with 100 percent outside air.

Cooling Requirements: 44,000 cfm of supply air at 72 F DB temperature.

Given: Outside air conditions = 95 F DB and 70 F WB entering washer.

Solution: The entering air state point is at point *A* on Fig. 1. Since the wet bulb temperature of the air will not change during the adiabatic cooling process, the leaving air condition will be at point *C* on the 70 F WB line at the required 72 F DB temperature. The leaving air conditions can be read from the psychrometric chart as 72 F DB, 70 F WB, 69 F DP and 90 percent RH. The spray water temperature reaches an equilibrium with the wet bulb temperature and remains constant at 70 F, as indicated by point *S*.

To evaluate the performance of an evaporative cooler, the terms saturating effectiveness *E*, or evaporative cooling efficiency meaning the same thing, are used. This relationship can be defined as the ratio of the actual lowering of the air temperature to the wet bulb depression—the difference between the entering dry and wet bulb temperatures. The following formula for saturating effectiveness is given in the 1954 edition of the ASHVE Guide:

$$E = (t_e - t_1) / (t_e - t_{wb}) \quad ..[1]$$

where E = saturating effectiveness ratio;
t_e = entering air dry bulb temperature;
t_1 = leaving air dry bulb temperature;
t_{wb} = entering air wet bulb temperature.

Equation No. 1 does not apply when there is cooling with dehumidification. It applies only to an evaporative cooling process wherein the wet bulb temperature of the air remains constant and the spray water is neither heated nor cooled.

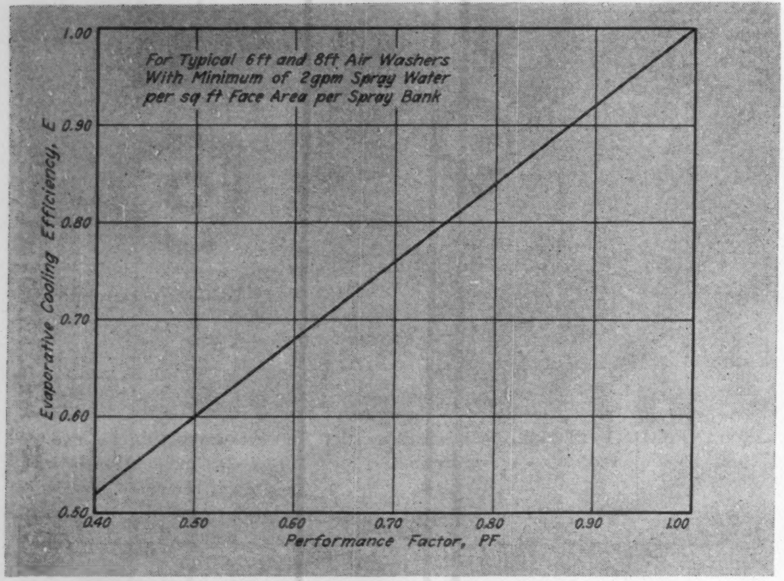
From equation No. 1: $E = (95 - 72)/(95 - 70) = 0.92$

From Table 1, which gives typical values for saturating effectiveness for various types of commercial air washers when used as evaporative coolers, it can be seen that a single spraybank washer will not provide the necessary saturating efficiency. A two spray bank washer with opposing spray banks and about 8 ft long will give the required efficiency when handling about 2 gpm per sq ft of face area per spray bank. It normally does not improve the evaporative cooling efficiency to spray more than 2 gpm per sq ft face area per spray bank, or 4 gpm total per sq ft with 2 spray banks.

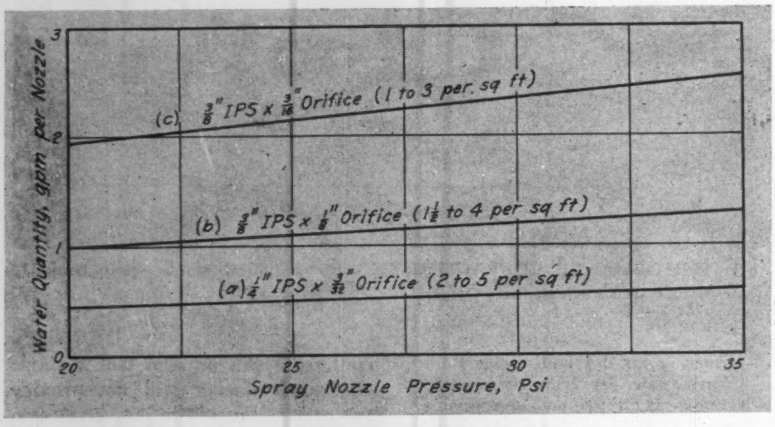
A somewhat closer selection may be made using the curves in Figs. 2, 3 and 4 which have been derived from the published data of one of the manufacturers of air washers. This manufacturer relates saturating efficiency, *E* to performance factor, *PF*, in Fig. 4. From this curve, at the required 92 percent saturating efficiency, the performance factor is 0.90. Using Fig. 2 for a two spray

TABLE 1—SATURATING EFFECTIVENESS or efficiency of air washers (when used as evaporative coolers)

No. of spray banks	Direction of water spray	Length of washer, ft	Percent efficiency or saturating effectiveness
1	With air flow	4	50 to 60
1	With air flow	6	60 to 75
1	Against air flow	6	65 to 80
2	With air flow	8 to 10	80 to 90
2	Opposing each other	8 to 10	85 to 95
2	Against air flow	8 to 10	90 to 98



4 EVAPORATIVE COOLING efficiency as related to the performance factor for a typical air washer of one manufacturer



5 TYPICAL SPRAY nozzle performance curves like these are helpful in the design of the air washer for particular applications

bank washer, we find that 0.90 *PF* is obtained at an air velocity of 500 fpm and with a spray pressure of 24 psi.

Since air washers are rated at standard air conditions — 70 F DB temperature, 29.92 in. mercury, and a specific volume of 13.35 cu ft per lb — the air quantity should be corrected to standard air before selecting the washer. In this problem, the requirements are 44,000 cfm at the air washer outlet conditions of 72 F DB, 70 F WB, 90 percent RH and specific volume = 13.72 cu ft per lb.

Correcting the cfm for standard conditions, the standard cfm of air is (44,000) × (13.35)/13.72 = 42,700 cfm. With this air flow rate and an air velocity of 500 fpm, the washer face area is (42,700)/(500) = 85.4 sq ft.

Use size "b" — ⅜ in IPS x ⅛" orifice — spray nozzles and 1½ to 2 gpm per sq ft face area per spray bank. From Fig. 5 at a spray pressure of 24 psi, each nozzle will deliver 1.07 gpm.

Then, (85.4 sq ft) (2 gpm per sq ft) (2 spray banks) = 342 gpm, and (342 gpm)/(1.07 gpm per nozzle) = 320 nozzles, or 160 nozzles per spray bank. Therefore, (160 nozzles)/(85.4 sq ft) = 1.87 nozzles per sq ft of face area per spray bank.

It will usually be found that air washer rating tables are based on the correct number of nozzles and water quantity for effective evaporative cooling, in this case from 250 to 350 gpm for two spray banks.

Cooling and Dehumidifying

The following example illustrates the application of air washers when used to cool and dehumidify with a high latent heat load and with recirculated air.

Load Requirements: Room sensible load = 42.25 tons of refrigeration = 507,000 Btu per hr = Q_S. Room latent load = 15.00 tons = 180,000 Btu per hr = Q_L. Room total load = 57.25 tons = 687,000 Btu per hr = Q_t. Room sensible heat ratio = Q_S/Q_t = (507,000)/(687,000) = 0.74.

Operating Conditions: Room = 80 F DB temp. & 67 F WB temp. Outside air = 95 F DB temp. & 70 F WB Temp. 75 percent recirculated air, 25 percent outside air. Entering chilled water temp. = 48 F.

Find: Air quantity required and size of air washer. Air washer leaving DB and WB temperatures. Spray water quantity and leaving temperature. Size and number of spray nozzles. Total refrigeration load.

Solution: Locate the outside air conditions at point *A* and the room conditions at point *B* on Fig. 6. The mixed air condition entering the washer with 25 percent outside air and 75 percent recirculated air will fall on the straight line between *A* and *B* at point *E* where the DB temperature is (80) (¾) + (95) (¼) = 60 + 23.75 = 83.75 F. From the psychrometric chart, the other conditions at point *E* can be determined as 67.7 WB — 32.2 Btu per lb — 59.7 F WB — 77 grains per lb, and 44 percent RH.

The room load ratio line may be drawn on a psychrometric chart through point *B* if the chart has sensible heat ratio lines. It is, however, easy to determine the slope of the load ratio line by calculating the two coordinates, DB temperature and grains of moisture per lb of dry air, from the room sensible and latent heat loads. This can easily be accomplished by the use of the following two relationships. Q_s = (lbs air per hr) (Sp ht) $(t_r - t_s)$ =

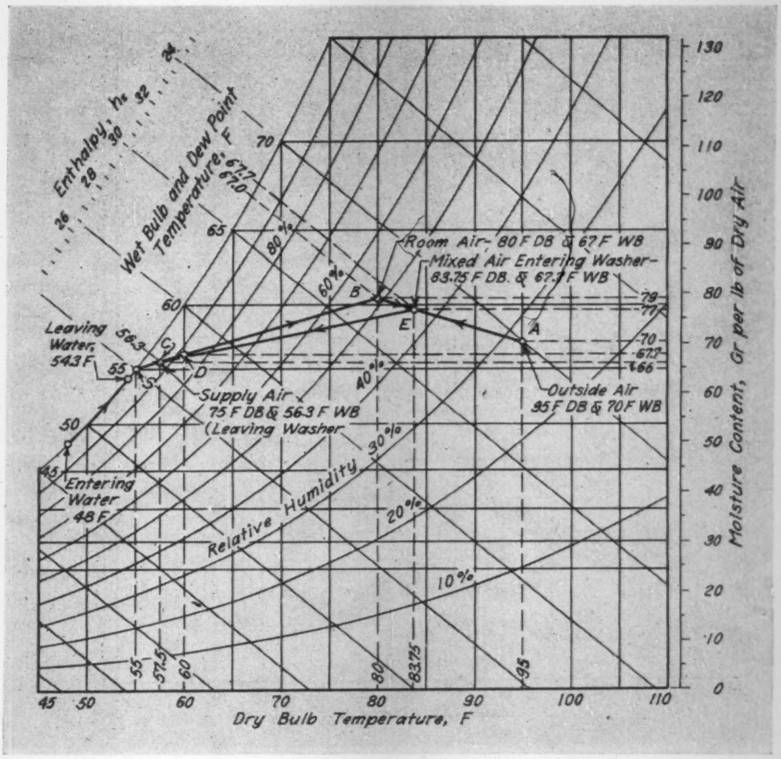
$[(\text{cfm})\ (60)\ (0.24)\ (t_r - t_s)]/(\text{Specific volume}) = 1.08\ (\text{cfm})\ (t_r - t_s)$. $Q_L = [(\text{lb air per hr})\ (G_r - G_s)\ (1060\ \text{Btu per lb})]/(7000\ \text{Grains per lb}) = [(\text{cfm})\ (60)\ (G_r - G_s)\ (1060)]/[(\text{Sp. vol.})\ (7000)] = [(\text{cfm})\ (63{,}600)\ (G_r - G_s)]/[(13.35)\ (7000)] = 0.68\ (\text{cfm})\ (G_r - G_s)$.

where Q_s = Sensible heat load in Btu per hr. Q_L = Latent heat load in Btu per hr. Sp. vol. = 13.35 cu ft per lb for standard air at 29.92 in. mercury, 70 F temperature, and a density of 0.075 lb per cu ft. Sp. ht. = specific heat at constant pressure = 0.24 Btu per lb per F for air. t_s = Supply air DB temperature. t_r = Room DB temperature. G_s = Grains of moisture per lb of supply air. G_r = Grains moisture per lb of room air.

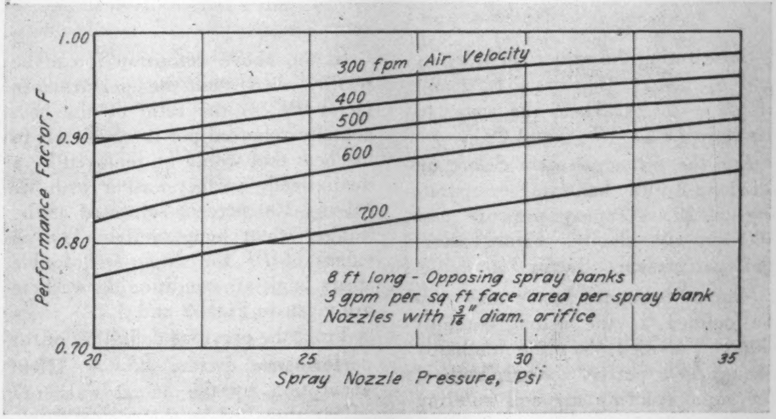
Since the weight of air — rather than the cfm — throughout the cycle is constant, by carrying all calculations through on a standard air basis, the same effect is obtained as if the weight of air were used. To calculate the coordinates for the load ratio line, an approximate supply air quantity must be determined. A good rule is to supply the air 15 to 25 F below the room temperature. In this case try a temperature difference of 20 F making the supply air 60 F. $Q_s = (42.25\ \text{tons})\ (12{,}000) = 507{,}000$ Btu per hr. Also, $Q_s = 1.08\ (\text{cfm})\ (t_r - t_s)$. Therefore, $507{,}000 = (1.08)\ (\text{cfm})\ (80-60) = 21.6\ (\text{cfm})$. Solving for the cfm, $(507{,}000)/(21.6) = 23{,}450$.

$Q_L = (15\ \text{tons})\ (12{,}000) = 180{,}000$ Btu per hr. Also, $Q_L = 0.68\ (\text{cfm})\ (G_r - G_S)$. Therefore, $180{,}000 = (0.68)\ (23{,}450)\ (79 - G_S) = (15{,}950)\ (79 - G_S)$. Simplifying, $(79 - G_s) = (180{,}000)/(15{,}950) = 11.3$. Solving for G_S, $(79 - 11.3) = 67.7$ grains per lb of dry air.

Locate point *D* at 60 F DB temperature and 67.7 grains per lb and draw the line *BD* which is the room load ratio line. The extension of line *BD* to the saturation curve at point *S* determines the indicated apparatus dewpoint of 55 F which is the lowest supply air temperature that will satisfy the given room sensible and latent load proportions. If the air washer would completely saturate the air when cooling and dehumidifying, the supply air temperature would be 55 F saturated. However, no washer is 100 percent perfect, so the supply air temperature must be higher than 55 F and must fall on the room load ratio line *BDS*.



6 HIGH LATENT LOAD — The psychrometric analysis for an air washer used in cooling and dehumidifying with a high latent load and with 25 percent outside air is shown here

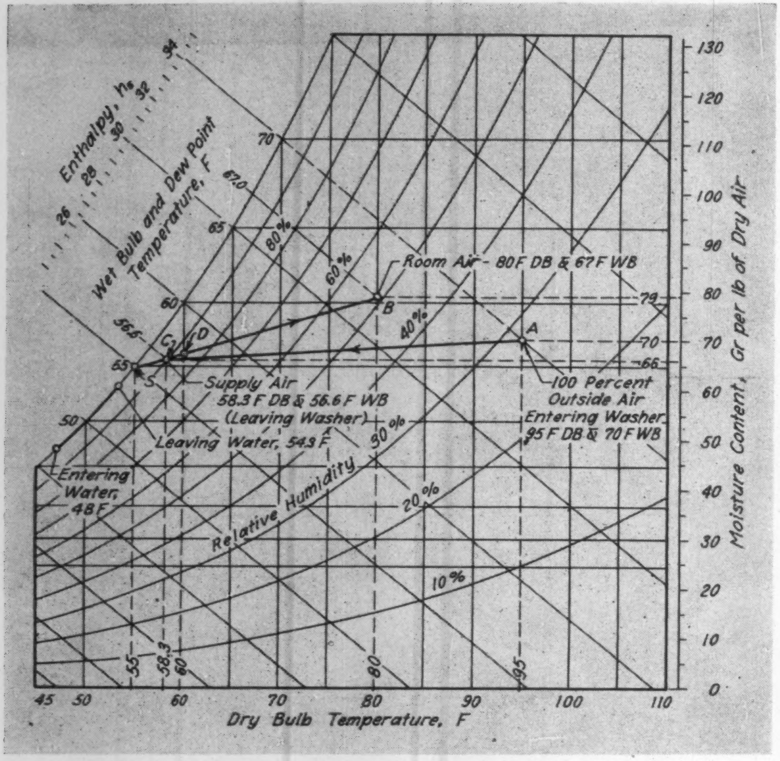


7 THE PERFORMANCE factor *F* for a typical two spray bank dehumidifier may be obtained from these representative curves

The perfect washer performance will occur approximately along the line *ES*, from the mixed air condition entering at point *E* to saturated condition leaving at the apparatus dewpoint at point *S*.

For the perfect washer: Leaving air temperature = Leaving water temperature = 55 F = ADP. Enthalpy, h_e, at 67.7 F WB entering = 32.2 Btu per lb. Enthalpy, h_s, at 55 F ADP = 23.2 Btu per lb. Therefore, the enthalpy removed $= h_e - h_s = 9.0$ Btu per lb. Knowing that the heat absorbed by the water = the heat removed from the air then, $(W_w)\ (t_2 - t_1) = (W_a)\ (h_e - h_s)$.

where, t_1 = Water temperature entering = 48 F, t_2 = Water temperature leaving, W_w = Weight of water, lb, W_a = Weight of air, lb.



8 LOW LATENT LOAD — The psychrometric analysis for an air washer used in cooling and dehumidifying with a low latent load and with 100 percent outside air is shown here

Substituting the values for t_2, t_1, h_e and h_s, $(W_w)\ (55 - 48) = W_a\ (32.2 - 23.2)$. Then, the water to air ratio $(W_w)/(W_a) = 1.29$.

For the actual washer: Select an 8 ft long 2 spray bank washer operating at 25 psi spray pressure and 500 fpm air velocity. From Fig. 2, the performance factor is 0.905.

The performance factor may also be defined as the actual enthalpy change divided by the enthalpy change in a perfect washer, both at the same entering air and entering water conditions. Such a ratio or efficiency represents the heat equivalent of the actual work done divided by the heat equivalent of the theoretical work done by a perfect washer. This may be expressed as follows:

$$PF = (h_e - h_c) \;/\; (h_e - h_s) \quad ..[2]$$

where PF = performance factor; h_e = enthalpy at entering air wet bulb temperature; h_c = enthalpy at leaving air wet bulb temperature under actual conditions; h_s = enthalpy of saturated air leaving the theoretically perfect washer at the apparatus dewpoint temperature.

In the above definition it can be readily seen that the performance factor *PF*, is the ratio of the heat actually removed per lb of dry air to the heat that would be removed by a theoretically perfect washer with air leaving 100 percent saturated at the leaving water temperature. Typical values of *PF* for single and double spray bank air conditioning washers are given in Figs. 2 and 3.

From the previous definition of the performance factor, PF = (Heat absorption by the actual washer)/(Heat absorbed by the perfect washer) $= (h_e - h_c)/(h_e - h_s)$. Or $0.905 = (32.2 - h_c)/(32.2 - 23.2) = (32.2 - h_c)/9$. Simplifying, $(32.2 - h_c) = 8.15$, and $h_c = 32.2 - 8.15 = 24.05$. The corresponding WB temperature = 56.3 F.

Point *C* can now be located on the room load ratio line *BDS* at a WB temperature of 56.3 F. The air conditions leaving the actual washer are 57.5 F DB, 56.3 F WB, 55.5 F DP and 93 percent RH. A slight error is introduced at this point by the shift of the overall load ratio line from *ES* to *EC*, but when leaving air conditions are close to the saturation curve, the error is hardly perceptible on the psychrometric chart.

To determine the leaving water temperature, t_2, the water to air heat balance is used with the water to air ratio as determined for the perfect washer. This may be determined from the relationship $(W_w)\ (t_2 - t_1) = (W_a)\ (h_e - h_c)$. Simplifying, $(W_w)\ (t_2 - 48)/(W_a) = 32.2 - 24.05 = 8.15 = 1.29\ (t_2 - 48)$. Or $(t_2 - 48) = (8.15)/(1.29) = 6.3$. Solving for t_2, $48 + 6.3 = 54.3$ F leaving water temperature.

The leaving air condition may be checked from Fig. 7 and equation No. 3. Equation No. 3, is given below, which defines the performance factor, *F*, and is that which has been adopted by the National Association of Fan Manufacturers in its Bulletin 107:

$$F = 1 - [(t'_{wb} - t'_w) \;/\; (t_{wb} - t_w)] \quad \ldots\ldots\ldots\ldots[3]$$

where F = performance factor; t_{wb} = entering air wet bulb temperature; t'_{wb} = leaving air wet bulb temperature; t_w = entering water temperature; t'_w = leaving water temperature.

Applying the above equation to a perfect washer in which the leaving air and leaving water are at the same temperature $(t'_{wb} = t'_w)$, it can easily be seen that the performance factor *F* will be unity. Typical values for *F* for a two spray bank dehumidifier are given in Fig. 7.

From Fig. 7 for an air velocity of 500 fpm and a spray pressure of 25 psi, the performance factor, *F*, will be 0.90. Applying equation No. 3, $F = 1 - [(56.3 - 54.3)/(67.7 - 48)] = 1 - (2)/(19.7) = 0.898$, which checks with the value of 0.90 obtained from Fig. 7.

The actual supply air quantity and total tons refrigeration may now be calculated as follows: Room Q_s = 507,000 Btu per hr = (1.08) (cfm) (80 − 57.5) = (24.3) (cfm). Solving for cfm, (507,000)/(24.3) = 20,900 cfm of standard air. The area of the washer face required, would be (20,900)/(500) = 41.8 sq ft. The weight of air flowing would be (20,900)/(13.35) = 1570 lb per min.

The overall Q_s = (1.08) (cfm) (83.75-57.5) = (1.08) (20,900) (26.25) = 592,000 Btu per hr = 49.33 tons of refrigeration capacity. The total load including outside air

= Q_t = (lb per min of air) (60) ($h_e - h_c$) = (1,570) (60) (32.2 − 24.05) = 767,000 Btu per hr, which is 64 tons of refrigeration capacity. Then, the overall Q_s/Q_t = (592,000)/(767,000) = 0.77.

Spray Water and Nozzle Calculations are given below: W_a = 1570 lb per min. W_w/W_a = 1.29. Solving for W_w (1.29) (1570) = 2025 lb per min of water, which is also 244 gpm. As a check, (64 tons) (24 gal per ton per deg F)/(6.3 F range) = 244 gpm. Or, (244 gpm)/(41.8 sq ft of face area) = 5.85 gpm per sq ft of face area. Use 2 spray banks at 3 gpm per sq ft per spray bank. From Fig. 5, type "b" nozzles — ⅜ in. IPS x ⅛ in. orifice — will deliver 1.1 gpm at a spray pressure of 25 psi.

The number of nozzles required would be (244 gpm)/(1.1 gpm per nozzle) = 222, or 111 nozzles per spray bank. Or, the number of nozzles per sq ft of face area per spray bank would be (111 nozzles)/ (41.8 sq ft of face area) = 2.66.

A summary of the conditions which would be found in this application are as follows: The split between the leaving air DB & WB temperatures is 57.5 − 56.3 = 1.2 F, and the split between the leaving air DB & the leaving water temperatures is = 57.5 — 54.3 = 3.2 F. The supply air flow rate = 20,900 cfm, requiring a washer with 41.8 sq ft of face area. The supply water flow rate = 244 gpm, requiring 222 size "b" nozzles. The total cooling load = 64 tons of refrigeration capacity.

Cooling and Dehumidifying

The following example illustrates the application of air washers when used to cool and dehumidify with a low latent heat load and with 100 percent of outside side introduced.

Requirements and Conditions: The conditions are the same as in the previous example with cooling and dehumidifying, except that 100 percent outside air is used instead of 25 percent. This application might be used where cold well water is available.

Solution: The room load ratio line *BDS* will be the same as in the previous example. The overall load ratio line and the total refrigeration load will be different, however, when using 100 percent outside air at the rather dry conditions of 95 F DB & 70 F WB.

For a perfect washer, the leaving air temperature = leaving water temperature = 55 F. The entering air conditions = 95 F DB & 70 F WB, and the entering enthalpy, h_e, at 70 F WB = 34.1 Btu per lb of dry air, while the leaving enthalpy h_s at 55 F ADP = 23.2 Btu per lb of dry air. Therefore, the enthalpy removed = $h_e - h_s$ = 10.9 Btu per lb of dry air. The heat absorbed by the water = the heat removed from the air. Then, (W_w) ($t_2 - t_1$) = W_a ($h_e - h_s$). Substituting, (W_w) (55-48) = (W_a) (34.1 − 23.2) = (W_a) (10.9). Solving for the water to air ratio, (W_w)/(W_a) = (10.9)/(7) = 1.56.

For an actual washer, for which an 8 ft long 2 spray bank washer is used, as in the previous example in which a spray pressure of 25 psi and an air velocity of 500 fpm are the conditions, the performance factor is 0.905, as before.

Then, substituting values in equation No. 2 for this example, *PF* = 0.905 = (34.1 — h_c)/(34.1 − 23.2) = (34.1 − h_c)/(10.9). Solving for h_c, 34.1 — (10.9) (0.905) = 24.25 Btu per lb of dry air, and the corresponding WB temperature = 56.6 F

Point *C* can now be located on load ratio line *BDS* at a WB temperature of 56.6 F. Again, a small error is introduced by shifting the air washer load ratio line from *AS* to *AC*, but the error is negligible in this region of the psychrometric chart. The air conditions leaving the actual washer are 58.3 F DB, 56.6 F WB 55.5 F DP and 92 percent RH.

The leaving water temperature may be obtained by using the water to air heat balance. (W_w) ($t_2 - t_1$) = (W_a) ($h_e - h_c$). Substituting the values, (W_w) (t_2 − 48)/(W_a) = 34.1 − 24.25 = 9.85. Or, (1.56) (t_2 − 48) = 9.85. Solving for t_2, 48 + 6.3 = 54.3 F.

A check of this may be made by using Fig. 7 and equation No. 3 for performance the factor, *F*, = 0.90 with a spray pressure of 25 psi and an air velocity of 500 fpm. Substituting values in equation No. 3 for this example, F = 1 − [(56.6 − 54.3)/(70 − 48)] = 1 − (2.3)/(22) = 0.896. This value checks with the value of 0.90 obtained by using Fig. 3. Continuing the example, the room Q_s = 507,000 Btu per hr = (1.08) (cfm) (80 − 58.3) = (23.4) (cfm). Solving for cfm, (507,000)/(23.4) = 21,700 cfm of standard air. Or, (21,700)/(13.35) = 1625 lb of air per min. The face area of the washer is (21,700 cfm)/(500 fpm) = 43.4 sq ft.

The overall Q_s = (1.08) (cfm) (95 − 58.3) = (1.08) (21,700) (36.7) = 860,000 Btu per hr = 71.66 tons of refrigeration capacity. The total load, including the outside air load = Q_t = (lb per min of air) (60) ($h_e - h_c$). Substituting the values for this example. Q_t = (1625) (60) (34.1 − 24.25) = 960,000 Btu per hr = 80 tons of refrigeration capacity. The overall Q_s/Q_t = (860,000)/(960,000) = 0.90.

Spray water and nozzle calculations. We know that W_a = 1.625 lb per min, and (W_w)/(W_a) = 1.56. Solving, W_w = (1.56) (1625) = 2530 lb per min of water. Or, this is equivalent to 304 gpm.

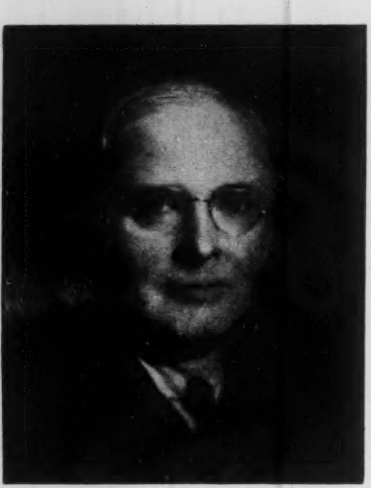
Check. (80 tons) (24 gal per ton per F)/(6.3 F range) = 304 gpm. Then, (304 gpm)/(43.4 sq ft) = 7 gpm per sq ft face area. Use 2 spray banks at 3½ gpm per sq ft per spray bank.

From Fig. 5, type "b" nozzles — ⅜ in. IPS × ⅛ in. orifice — will deliver 1.1 gpm at a spray pressure of 25 psi. Then, (304 gpm)/(1.1 gpm per nozzle) = 276 nozzles, or 138 nozzles per sq ft per spray bank. Then, it follows that (138 nozzles)/(43.4 sq ft of face area) = 3.18 nozzles per sq ft face area per spray bank would be required.

A summary of the conditions which would be found in the application are as follows: The split between the leaving air DB & WB temperatures is = 58.3 − 56.6 = 1.7 F, and the split between the leaving air DB & the leaving water temperature is = 58.3 − 54.3 = 4 F. The supply air flow rate = 21,700 cfm requiring a washer with 43.4 sq ft of face area. The spray water flow rate = 304 gpm, requiring 276 size "b" nozzles. The total cooling load = 80 tons of refrigeration capacity.

Comparison with previous example: From a comparison of the results in these two examples, it can be seen that smaller splits between leaving air DB and WB, and between leaving air DB and leaving water temperature, are obtained when the overall sensible heat load ratio Q_s/Q_t is low. In other words, the splits will be smaller when the latent heat proportion of the total load is higher.

Tapping the Hot Water Boiler



SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems. This month, he gives his answers to some questions about adding a load on an existing hot water heating boiler.

A FRIEND has a sectional cast iron hot water heating boiler. He discloses that there are two top tappings for water to flow away from the boiler, one in the front section and one in the rear section. This permits us to deduce that the boiler is of the horizontal type, with sections assembled like slices of bread in a loaf, rather than like pancakes, as would be the sections of a vertical cast iron boiler.

In this case, the boiler is suspected of having about as much to do as it can do, but the owner wishes to add another burden, by making the boiler heat domestic hot water as well.

Install Additional Pump

The proposition is to install a water circulating pump to encourage the flow of water from the outlet in the top of the front section of the boiler, through the radiators, then to the pump and back into the boiler at the bottom of the rear section. This is a conventional arrangement.

Then, it is proposed to connect a second flow pipe from the boiler to a copper coil submerged inside a relatively small tank. The water leaving the copper coil is to flow to a second pump which will force it back into the boiler through a bottom or low opening in the rear section of the boiler. The domestic water flows from the relatively small tank to the points of consumption and back to the tank, and does not mix at all with the boiler water.

Where to Tap Openings?

My friend asks: "At what section of the cast iron boiler should the flow connection from it to the hot water coil in the tank be taken, in order to interfere least with the heating of the radiators?"

Query No. 1. Would you take both of these hot water supplies from the same outlet on the boiler? In reply to this, I would take both from the top of the front section. With the return water entering the bottom of the rear section, the overall water circulation through the boiler should be most effective. If the domestic service circulation enters the bottom of the rear section and leaves at the top of that section, the area of contact of the water with hot gases would be relatively small.

Query No. 2. Would it be correct to say that either of the piping arrangements would tend to make the boiler less capable of heating the building? My answer to this would be that if the same fuel burner and heat transfer device, primarily designed to heat the radiators in a building, shall have added to its duty the heating of domestic water, the capacity of the boiler for heating must be reduced accordingly. If the original boiler, however, was too large for its original job, and if more work is loaded on it, so that the duty and the ability shall match each other, then the efficiency might be improved. Capacity and efficiency must not be confused.

Query No. 3. If the boiler is just barely large enough to heat the building, after adding the domestic water demand would you take all the flow water from the front section rather than connect the domestic water heater separately from the top of the rear section? In answer, I would still take all the hot water from the front section. However, before arriving at any specific conclusion, one should know the sizes of the openings and the capacities of the pumps, the kind of fuel, the chimney height and the heat requirement for both flow circuits in relation to the rated output of the boiler.

Two Million Room Units To Be Sold Next Year?

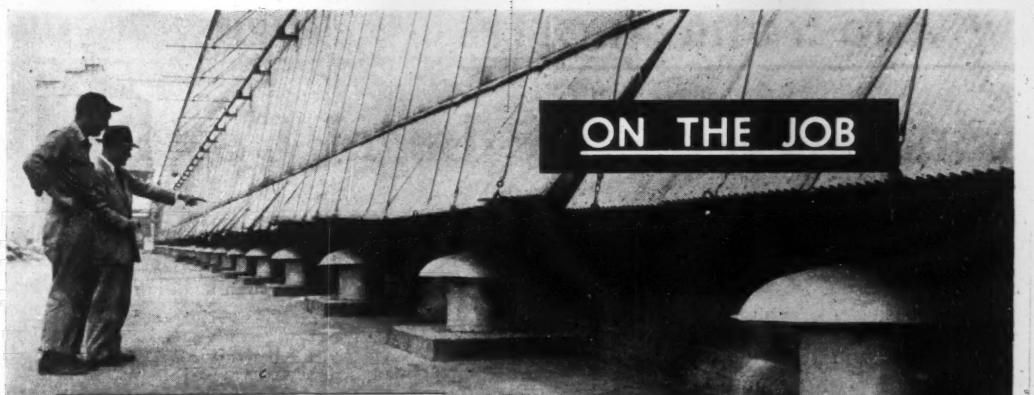
. . . worth $700 million

ANNUAL SALES in excess of $2 billion were predicted for the room unit air conditioning industry by Robert E. Cassatt, national sales manager, Fedders-Quigan Corp., recently.

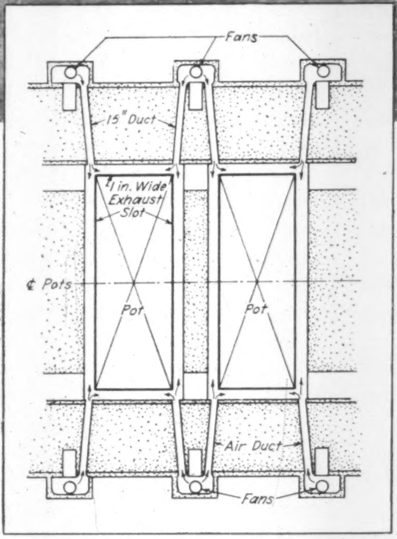
He indicated that industry sales next year will be two million units, worth $700 million at retail. He emphasized that attainment of the $2 billion annual sales goal may depend upon the success of efforts to lick the problem of financing inventories at the factory, distributor and dealer levels.

He cited inadequate wiring as one of the serious problems confronting the industry.

ON THE JOB



THE DUCT FAN units with weather heads are immediately outside the potrooms.



COOLING AIR, introduced under the pots through four ports near the corners of each pit, is exhausted through the 1 in. slot around the perimeter of the pot.

324 Fans Cool Reduction Pots

J. W. Hutchison
Manager, Robert P. Patterson Plant
Reynolds Metals Co.

An unusual cooling problem presented itself to the company engineers in the planning of the new Reynolds plant at Arkadelphia, Ark. The problem involved a method for cooling electrolytic cells and bus bars. These cells are the pots in which alumina is electrolytically reduced to form aluminum.

The problem was unique because high temperature is a necessity to keep the bath molten for the reduction process. Direct current is used to maintain a temperature of approximately 1775 F. This electrical current decomposes the alumina into oxygen and pure molten aluminum. However, the heat has to be kept away from electrical bus bars which are immediately adjacent to the pots. As the bus temperature increases, the electrical resistance increases, resulting in a power loss and decreased efficiency.

Therefore, the ventilating system has to cool the bus and also cool the exterior steel shell of the pot to prevent this shell from heating the bus by radiation. Another reason for cooling the shell is to prevent excessive heating and consequent deterioration of the carbon lining.

The problem was solved by blowing cool outdoor air into the pit beneath each pot. The air forced into the pit cools the bus and steel pot shell and exhausts through a 1 in. slot around the entire perimeter.

To provide this cooling air, 324 axial flow fans were supplied. These fans have 14 blade, 21 in. diameter, axial flow pressure fan wheels, directly driven by a $\frac{3}{4}$ hp motor at 1150 rpm. Weather heads are provided on 250 of these units. The other 74 units are incorporated in the ductwork inside the building. Each unit with a head delivers 3000 cfm of air at 0.37 in. static pressure. Each unit without a head delivers 3110 cfm at 0.40 in. static pressure.

This new cooling system has reduced the temperature of the electrical buses 70 to 100 F. Since lowering the bus temperature is the purpose for which the system was installed, this design is proving to be completely satisfactory.

[Photo from DeBothezat Fans Div., American Machine and Metals, Inc.]

THE LAW AND YOUR PROFITS

Mechanics' Liens Are Legal Upstarts

WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background. This month he discusses the limitations of mechanics' liens for the contractor.

FOR HUNDREDS of years, English speaking peoples have recognized in their courts a body of precedent known as "common law." To this time honored fabric, all statutes and enactments are subject, including those that provide for mechanics' liens. Whatever the common law says or fails to say on the subject is, therefore, of governing importance.

Contractors have so habitually taken mechanics' liens for granted that it may surprise them to learn that such legal devices are not in harmony with the common law. In fact, these liens are looked at with lifted eyebrow by the courts. This attitude is well reflected in a recent decision: "Mechanics' liens are in derogation of the common law, and a statute creating them is to be strictly construed."

In this case, Soe & Soe entered into an agreement with Wye Knott Engineering Co., a general contractor, to make certain improvements on their property. Wye Knott, in turn, made a subcontract with Bedrok & Co. for setting a concrete block boiler foundation. (All names are imaginary.)

Bedrok quoted by telephone a price of $1 per block to cover the labor, necessary material and profit. Remaining unpaid, he served notice on the owners, Soe & Soe, that he had been employed by contractor Wye Knott on foundation work. Ten days later, Bedrok filed his claim against Soe & Soe for lien. The claim included a considerable amount of other work on the job, supposedly the subject of agreement between Bedrok and Wye Knott.

The owners, Soe & Soe, in their defense, asserted that Bedrok's lien covered only the work set forth in the notice, but the trial court thought otherwise and granted him relief for the full amount.

On appeal, this judgment was reversed by the appellate court of the state. The court's reasoning, reduced to a few words: "A mechanics' lien is a claim which, without consent of the property owner, becomes a mortgage on the property, minus those formal requirements of signature, acknowledgment and recording essential to a mortgage or trust deed. Therefore, any extension of such a claim ought not to be permitted except upon strict compliance with the statute."

Since written notice of a mechanics' lien is the only document on which the property owner may rely, any extension of its terms should be in specific writing. When foreclosing a mechanics' lien, the plaintiff cannot enlarge the scope of the claim originally presented.

So much for mechanics' lien strictness as illustrated by one case impinging on the heating and air conditioning field. However, there are other cases in current records also bringing out important principles of mechanics' lien technique.

Profit Limited

In a mechanics' lien suit for a balance claimed under a cost plus contract, the supreme court of another state held on appeal that under such contract, the performing party's profit is limited to the amount specified. The court ruled that the contractor was not entitled to a commission on the cost of materials purchased by owners for which he incurred no liability, nor could he charge for making changes in blueprints, nor for services of an accountant requested by the owners, nor for the contractor's own services in laying out and directing piping work upon which he collected from the piping subcontractor a 5 percent rebate.

In another case in a different state, a supplier of materials mailed a notice of intention to assert a mechanics' lien against realty on the 34th day after furnishing the last item. However, notice was not received by the realty owner until the 36th day. The court of appeals of this state held that the notice was insufficient to comply with a 35 day statutory requirement. The material supplier's claim was therefore thrown out.

In still another state, a job was never finished. The furnisher of labor and materials did not register his claim within 90 days from completion or termination of his contract. His failure, ruled the court of appeals of that state, resulted in his having "no lien." The local bank, which held a mortgage on the property, stepped in ahead of him because of his technical neglect.

Since this discussion applies to actual cases, it can be seen that legal rules vary in different states.

QUESTION OF THE MONTH

How Prevent Piping Corrosion?

THE QUESTION *How Can We Protect Snow Melting Piping Against Corrosion?* was published previously in HPAC and is repeated here for information along with an answer to the question that has been received from one of HPAC's readers. Other comments for publication will also be welcome.

"Many sidewalk and driveway snow melting systems have been installed in the last several years in the Boston area, using various piping materials. Two of the systems using one material were laid on 8 in. crushed stone beds, over which 5 or 8 in. concrete slabs were poured, so that the pipes have been partly encompassed by the concrete. One of the systems using another pipe material was laid in a reinforced concrete slab so that the pipes were completely covered with concrete. These systems have been installed and in operation for a period of three or four years.

"Because of a necessary excavation, the partly concrete-covered pipes were recently uncovered. It was found that the exterior lower surface of the pipe was pitted and that at a joint the lower section of the weld had "washed " away. Recently, several leaks occurred in one of the totally enclosed pipe systems. After getting to the pipe and examining several samples, considerable pitting on the exterior surface was evident and there were several pinholes through the pipe wall.

"One of the explanations for the above conditions is that there is severe electrolytic action present and this action is causing the wasting away of the metals.

"We would be interested in having any information as to the cause and cure for these conditions. Are there any known steps to be taken in the design of new systems of this type to prevent these conditions?"

JOE F. TATUM —

"Here Are Two Ways to Control Pipe Corrosion"

I WAS very much interested in the question on protecting snow melting pipe against corrosion. I believe that I can throw some light on the subject. Three basic facts are known, which are given below.

1) When steel is encased in concrete, its solution potential is changed from that of steel to approximately that of copper.

2) If copper and steel are connected together electrically, that is, by a low resistance current path, a destructive electrolytic current will flow from the steel to the copper, causing the steel to go into solution at the point of current departure.

3) Since the steel encased in concrete takes on the solution potential of copper, it will act like copper in that it will be cathodic to the steel that is not encased.

A simple experiment may be tried to verify these facts. Take a piece of steel, encase it in concrete approximately 1 in. thick and take a piece of similar bare steel. Immerse the two pieces of steel in a mild salt solution with a wire connected to each one. Then take a sensitive milliammeter of very low internal resistance and put the two wires on the ammeter. You will find that the concrete coated steel has a plus charge and the uncoated steel has a minus charge, indicating that the current is leaving the bare steel.

There are two very economical ways this can be controlled.

1) Be sure to encase all of the pipes completely in the concrete, and where the pipe leaves the concrete going to the source of hot water, put an insulating coupling right up next to the slab, coating any part up to the insulator on the slab side with concrete.

2) Apply cathodic protection to the steel in the slab so as to prevent the galvanic action by causing current to flow into the steel to make all portions thereof cathodic. The cathodic protection can be applied very economically by the use of magnesium anodes in small systems or by the use of rectifiers and graphite anode beds on the larger ones. In the case of the presently installed systems, I would recommend the immediate application of cathodic protection to prevent further destruction of the installation. — JOE F. TATUM, Consulting Engineer.

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

READER ASKS —

"How To Design Air Conditioning for Roller Skating Rink?"

"I am designing an air conditioning system for a roller skating rink, and I would like to ask if there is information available on estimating the cooling load for such an installation. What factors should be taken into account, and how should the variation in load be planned? What about air delivery and control of the system?

"The rink is a converted movie theater, 48 x 110 x 18 ft high and will accommodate 200 skaters at one time.

"I would like to see how other HPAC readers would approach this problem."—E.C.T.

The Case of the Musical Pump

. . . or How Much Damage Can Piping Do?

By Bill Dopp

• Bill Dopp has had some 40 years of experience dealing with piping, including a long stretch of service as a sales engineer. He is devoting part of his present leisure to drawing on his many piping experiences.

This month, Mr. Dopp's principal character, Martin MacVane, helps one of his old friends discover what is causing a new pump — installed in an existing system — to whistle and vibrate. He finds that the piping in this plant had not been properly designed to accommodate the addition of a new pump. He discusses the factors that are involved and proposes a solution for correcting this problem.

Martin MacVane looked around the little office of the engineer in the immaculate municipal power plant with a puzzled frown. There seemed to be no one around the place. He went out on the turbine room floor and found everything running smoothly, but there was surely something wrong with the station note. He got the sense of a high pitched whistling sound mixed with a terrific rattle. The sound came from below the main operating floor, so he walked toward the stairwell at the other end of the room. As he reached it, an attendant came bounding up the stairs. "Where's Harvey Davidson?" asked Mac.

"Down in the pump room," answered the young fellow, hurrying toward the instrument panels.

Centrifugal Pump "Music Box"

Mac went down the stairs slowly, across the heater deck and down a second stairway into the humid pump room. The shrieking whistle grew louder as he approached the group of people gathered around a motor driven centrifugal pump. Harvey greeted him with a wave of his hand since the noise was too loud for conversation. One of the operators turned the handwheel of the delivery line gate. As the valve opened wide, the shrieking stopped, to be replaced by an intense rattle that sounded like an electric drill going through concrete. Closing the valve partly, the rattle was replaced with a new piercing shriek. Finally, a solid silence enveloped the group as they stopped the pump.

"Nice music box you've got there," laughed Mac, extending his hand to Harvey. "Where did you get it?"

"It's a music box all right. This is a brand new pump, Mac. We just installed it. She starts off fine and quiet, but as soon as it gets up to speed, the blamed thing begins to rattle, and then the whistle starts. You can't hear yourself think. I'll be hanged if I can figure it out. Have to send for a pump man, I guess." He put his hand on Mac's shoulder. "How are you, anyway, old top?" he added as sort of an afterthought.

"I'll live all right," replied the genial gasket salesman, "but you won't, unless you stop that noise."

"What do you think might be the trouble, Mac?" the engineer asked.

"It could be any one of several things, or a combination of causes."

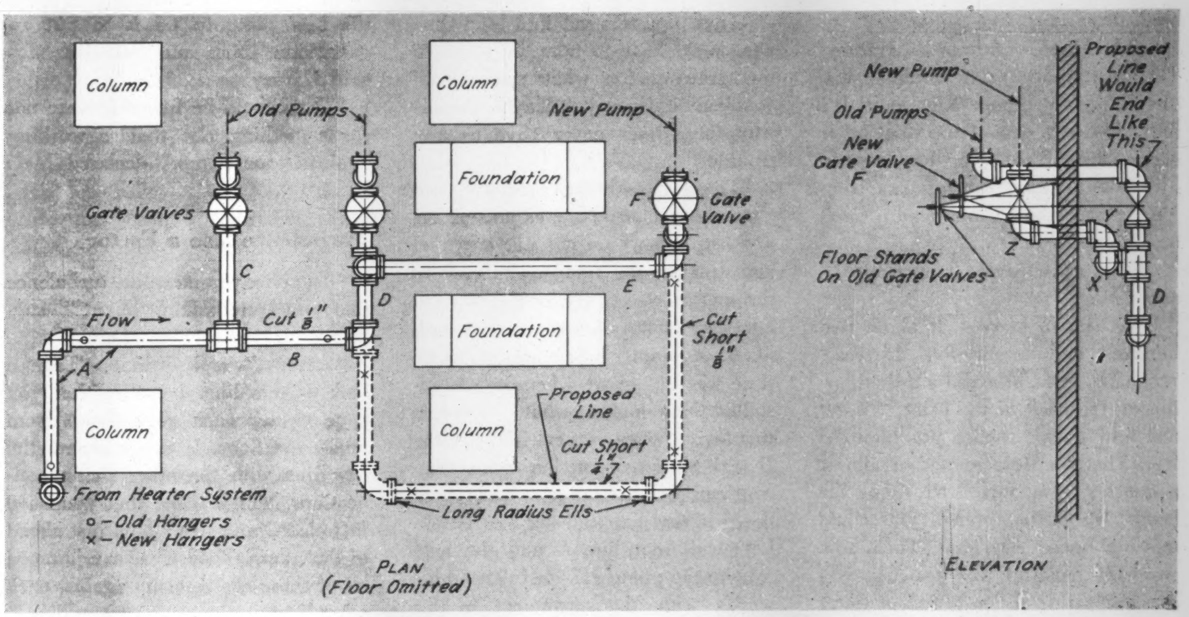
"It's funny that you can't seem to buy top quality equipment nowadays," complained Harvey. "Most everything you get has something wrong with it. You put it in, and then fuss with it for weeks before you get it running right." Mac and Harvey walked away from the offending pump.

"Were the Directions Read?"

"Did it ever occur to you that you might have something to do with that?" Mac chuckled. "My mother used to buy medicine, pass it around among the whole family, and then

---

All of the names in this article are fictitious.


Column
Column
Old Pumps
New Pump
Foundation
Gate Valves
F
Gate Valve
C
D
E
Flow →
Cut 1/8"
B
A
Foundation
Cut Short 1/8"
Column
Proposed Line
Column
Cut Short 1/4"
From Heater System
o – Old Hangers
× – New Hangers
Long Radius Ells
PLAN
(Floor Omitted)
New Pump
Old Pumps
New Gate Valve F
Proposed Line Would End Like This
Y
Z
X
D
Floor Stands On Old Gate Valves
ELEVATION

"LET'S TAKE A LOOK at the piping layout around that pump."

remark casually that she had better read the directions. Are you sure that you read the directions that came with this pump?" Mac's sidewise glance seemed to annoy Harvey.

"What do you mean, directions? Anyone knows how to install a pump. All you have to do is to get the foundation bolts in the right places and hook up the piping. Of course, you have to level it and prime it when you start it, but that's all there is to it.

"I don't suppose you got a card attached to that equipment telling you what not to do when you installed it?" Mac's inquiring gaze began to embarrass Harvey.

"I suppose so," the engineer replied, "but I'm not sure what became of it. That was just about oiling and that sort of thing, I'm sure."

"Harvey, I have a hunch. Let's take a look at the piping layout around that pump." They went into the office, where Harvey dug up a print from under a lot of old papers.

Another Pump "Tacked On"

"Here you are," he said, spreading the drawing on the desk. "You see we had to add another pump because we were driving our boilers pretty hard, and the two old steam driven centrifugals are not too reliable. The power load has been going up and up. This town has been talking about a new plant for years and years, but all they do is to install makeshift means of getting along with what they have here." He shrugged his shoulders in disgust. "So we tack on another feed pump and limp along. That is, if we get it to working."

"I take it that these are the two old pumps," said Mac, pointing to the drawing. "Why did you put this one way over here?"

"We had to get around the foundation of that big heater, and I did want to get it out in the open as much as possible. Then, too, this gave me a chance to cut into the suction line of the number two pump. That gave us a very compact piping arrangement under the floor."

"It's compact, all right," declared Mac. "Too compact, I'm afraid."

"What's wrong with it?" demanded the surprised engineer.

Was the Piping Cut Short?

"Did you cut this piping short when you installed it?" asked Mac.

Harvey did not answer immediately. Looking closely at the drawing, he frowned and rubbed his chin. "Gosh, Mac, I don't know. I'm afraid that we overlooked it. I know I figured the expansion and decided that if we cut that long pipe short it would be okay but I seem to have failed to put that cut on the drawing. I'm sure the fellows never gave it a thought when they installed the pipe. Do you suppose that has something to do with the way that pump acts?"

"It has a lot to do with it," said Mac, making himself comfortable in Harvey's chair. "One of these modern pumps is a fine piece of precision machinery. The clearances that are maintained between the impeller and the volute — that's what most people would call the casing — are very minute. With the pump running around eighteen hundred rpm, any change in those clearances is sure to cause trouble." Mac leaned back and eyed the ceiling. "That pump was carefully fitted and tested. It did not squeal when they had it on the test floor, so something has happened to it since it left there. I'll bet my last dollar that the expansion strains you have put on the suction cover of this pump are causing the impeller to bind. That's causing the squeal."

"Oh, Mac," exclaimed Harvey. "That little expansion couldn't distort that heavy pump. Why, look! It's only fourteen feet from the other suction line. That setup has been in for years without causing any trouble." Harvey shook his head. "Can't be," he declared.

"What's your water temperature?" asked Mac.

"We aim to keep it at about two hundred and seventy-five degrees," replied Harvey. Mac did a little figuring on the back of the print. "About one and a half inches per hundred feet. That's a little matter of almost a quarter of an inch." He shook his head. "Properly applied, you could move a house with that. Then, too, from the looks of this drawing, you are supporting the pipe full of water on that suction flange too. Don't you have a hanger holding up that pipe?"

"Well, no. There is a hanger on the number two pump suction, but we just omitted it." Harvey's apologetic answer made Mac grin.

High Expansion Load on Piping

"A high expansion load, in torsion at that, the weight of the pipe hanging on the pump inlet and excessive turbulence entering the suction eye! No wonder you are having trouble," Mac sighed. "Brother, how much damage can piping do?" he mused.

"What's this about turbulence?" demanded Harvey.

"Suppose we get this expansion thing straightened out first," suggested Mac. "Then we can take up the other things." He picked up a yellow pencil. "Let's mark these pipes *A*, *B*, *C*, and so on, so that we can talk intelligently." It took but a moment to put in the letters. "Now *A* is the downcomer from the heater and *B* is the line between the two old pumps. For the moment, let's ignore the new piping." Harvey had a skeptical expression, watching Mac. "From the fact that this note on *B* says to cut one eighth of an inch, I take it that all of the original pipe was cut to compensate for expansion," observed Mac.

"That pipe was put in a long time ago. We'll have to take the word of the drawing for what was done," commented Harvey. "Maybe that is why these lines never gave us any trouble."

"These lines were properly laid out originally, and the expansion, as you can see, would not put any special stress on the pumps. The leads to the suction covers are long enough to take care of the increase in the length of *B*. *A* would take care of itself, if it was cut short when it was installed. Now look at what you did to that layout when you cut into the line *D* with your new suction connection. You can see that the new line ties *D* down to this line and the new pump. Let's call that line *E* and the lead over to the pump *F*." He followed his words with the movement of his pencil.

Stress Is on the Pump

"I'm beginning to see what is wrong there," said Harvey. "That quarter of an inch of expansion is putting stress on both the pump and on the line that you have marked *D*."

"It's also putting stress on your number two pump," declared Mac. "I think that the rest of the line is exerting enough resistance to throw most of the movement toward the new pump. These forces will always try to establish a balance. One thing is sure, they will always find any weak spot. Right now it seems to be the structure of the new pump."

"Do you mean that the new pump is not strong enough?" asked Harvey hopefully. Any kind of an out looked good to him.

"No Harvey," replied Mac. "The pump's all right. I simply meant that this has proven to be the weakest link in the chain." He paused to turn the drawing. "You will note that with this riser — we'll call it *C* — and these elbows, you have the force acting as though they were a lever. You are getting a bell crank action that is putting the stresses into torsion. All of it is working against the pump."

"It's a cinch that something has to be done about that piping. I suppose the best thing to do is to put an expansion joint into that line *E*," said Harvey.

"That would be fine if it were not for something else that is working against your pump," declared Mac.

Turbulence also a Factor

"I suppose you mean the turbulence that you were talking about?" suggested Harvey.

"Exactly," replied Mac. "Take a look at this line. I realize that you have to approach your pump from under the floor. If you compare the new line with the other pump connections, you will see that you have introduced an extra elbow just ahead of the pump. Then you have jammed all of those ells right up against each other."

"I guess that's what ells are for," declared Harvey with a slightly sarcastic inflection.

"They are made to turn the direction of flow, all right, but they do something to the fluid in making that turn. The pipe length of an ordinary ell is about two pipe diameters, but —" Mac hesitated a moment, "the actual resistance of that ell to flow is about fourteen pipe diameters. What do you suppose makes the difference?"

"Frankly, Mac, I've never given it a thought," confessed Harvey sheepishly.

Elbows Cause Fluid to Spiral

"Whenever a fluid turns a corner in a pipe, the change of direction causes the fluid to begin a spiral motion, producing a whirl in the pipe behind the ell or bend. This turbulence is carried along the pipe for a greater or lesser distance depending on the velocity of the fluid and whether the flow was straight before entering the turn." Mac resorted to the use of his hands to make his meaning clear.

"You mean that it's like the way water sometimes comes out of a faucet?" asked Harvey.

"That's it, only more so," laughed Mac. "Roughly, we say that the turbulence effect will be carried for ten diameters before the flow straightens out. Look at those ells. Here's *X*, *Y* and *Z*. *X* puts turbulence into *Y*, which increases it. *Y* has only a short piece of pipe following it, so *Z* gets the full effect of the combination and adds its little mite to the collection. Then, you dump this agitated water into a gate valve, which adds a little bit more. That's a real whirlpool when it gets that far."

"But those other pumps have ells in the line, too." Harvey pointed to the print.

"Sure they do, but look at the difference in the relation of the ells to each other and to the valve. A gate valve creates relatively little disturbance in a line unless turbulence is introduced into it. So, the first ell gets fairly straight delivery. There is about five feet of pipe between the ells before the turn is made into the pump. Don't you see that there is a tremendous difference in the way the water is entering the old pumps?" Mac looked at Harvey inquiringly.

"I can see what you mean all right, but what difference does it make to the pump? If the water gets there, the pump will pass it on," Harvey commented stubbornly. "We have never paid any attention to that in laying out pump lines."

Pump Operating Cost Affected

Mac chuckled. "Harvey, when you buy a pump, you are not buying so many pounds of iron or steel," he said. "You are buying a service. The first cost of that service is only a small part of what you are going to pay. Every day that you use that service, you lay out good, hard earned money for it. Even when equipment stands idle, it's costing you money. Suppose that the power consumption of that pump turns out to be fifty percent more than you had expected it to be? You'll be on the neck of those pump people, pronto."

"I'll say I will," promptly declared Harvey. "Let's hear the rest of this."

"Pump designing is a highly specialized business," explained Mac. "The shape of the impeller and of the volute have to be exactly right for the particular purpose that the pump is intended to serve. Here you have hot water at a temperature above two hundred and twelve degrees. If this pump is not properly designed, it can quickly get steambound by the flashing of the hot water inside the pump. If you've never had a pump that does that, you really don't know what trouble is."

"You're making this very complicated," complained Harvey.

"It is complicated," replied Mac emphatically. "I'm trying to simplify it." He pointed to the drawing. "When you introduce violent turbulence into that pump, you destroy all of the ideal conditions upon which the original design was based. The designer assumed a straight flow of water to the pump inlet. That takes at least ten pipe diameters of straight pipe ahead of the inlet. You can have a certain number of adverse circumstances and still get top efficiency out of the equipment, but there are definite limits." Mac tapped the drawing with his pencil. "You may be forcing the impeller up against a thrust bearing when the designer intended that the vanes should pull it the other way. No one knows what is really going on there. Whatever it is, the pump does not like it. That's why it squeals and rattles. Better heed that protest." Mac got up with a slightly impatient gesture.

Mac Solves the Problem

"Sit down, Mac," said Harvey persuasively. "We're in trouble here. I can see that you have a pretty clear idea of how to remedy it. Won't you give us the benefit of your opinion?"

Mac cheerfully responded to the plea. "Of course, Harvey. You're welcome to it, for whatever it's worth." He picked up the yellow pencil. "Assuming that the pump is all right, here is what I would do. Take out that suction line and start over. Put a tee in place of the ell where *B* joins *D*. Then, go around this column and approach the pump straight, keeping at the same level as the old suction line. Cut the cross member short. That makes a loop which takes care of the expansion." He sketched in the new line. "Then, install the valves like the other valves, putting a floor stand on the floor above. Enter the pump in exactly the same way as the other pumps are entered. Then cross your fingers," he laughed. "I think that it will solve your problem."

"Your suggestion looks good to me, but I hate to cut another hole through that twelve inch concrete floor." Harvey made a wry face at the thought.

"It's up to you, Harvey," said Mac. "I'd do almost anything rather than live with that howling banshee out there." He got up to go.

"Thanks for your suggestion, Mac," said Harvey, as he smiled and shook his friend's hand. "I'll let you know how we come out. Good-bye now. Thanks again."

Mental Patients Sensitive to Heat

. . . "must be cooled"

THE RECENT Kansas heat brought a plea for help in saving the lives of patients at the state's training school for the feeble minded where three deaths were recorded. James Welch, personnel director of the Winfield institution, said mental patients of the mongoloid type are peculiarly sensitive to the heat.

These patients, he said in a radio appeal, must be treated with ice or otherwise cooled. He said there were 40 cases of heat prostration among 1400 patients and that some of the stricken persons were in critical condition.

At Topeka, Dr. George W. Jackson, director of state institutions, said 11 patients had died in Kansas mental hospitals in one week because of the heat.

HPAC DATA SHEET

Solar Irradiation of Walls and Windows

South-Facing: May-September

By R. F. Quan* and F. W. Hutchinson**

• In this first of a series of three articles, tabular solutions are presented for a south facing wall or window under summer conditions. The second and third articles will present similar data for walls facing east or west and southeast or southwest, respectively.

Data sheets on solar irradiation for the heating season months from October through April by Prof. Hutchinson were in the July 1949, the December 1950 and the May 1951 HPAC.

IN THE FIELDS of air conditioning and heating both the design and the operating engineers are frequently called on to provide precise information with respect to the statistically likely rate at which solar energy will be received on a given structure.

It is evident that for solar loads where irradiation rates vary with the time of day and day of the year, with orientation of the receiving surface and with latitude, the calculation of many hundreds of solar angles and the computation of resulting irradiation rates can be an arduous task. While this was done a few years ago for the winter months, there has not yet been published, so far as the authors are aware, the simple direct reading tables for the summer months which will enable the designer to select, rather than calculate, the basic irradiation rates and solar positions for a full range — within the U. S. — of latitudes and of orientations. By interpolation from the complete set of tables for summer and winter, the engineer can determine without calculation, the relative solar position and direct irradiation rate for any vertical wall at any daylight hour of the year.

Tables 1a through 4a, presented here are for latitudes of 30°, 35°, 40° and 45°, respectively. These four tables are for a south-facing wall or window from May 1st through September 30th. Although the hourly data in each table is for exact conditions on the 21st day of the month in question, for usual engineering needs this data can be used with adequate accuracy for any other day of the same month. In terms of solar relationships, the three basic quantities are time, altitude and azimuth.

The arrangement of all tables is essentially the same. The first column gives the month and the solar hour of the day. Data given in the tables is, in all cases, for conditions existing at the start of the stated solar hour. The second and third columns give the two fundamental angles that determine the sun's position: solar altitude, *H*, is expressed in deg above the true horizon; solar azimuth, *A*, is expressed in deg east of north for the morning hours and west of north for the afternoon hours. The angle, *B*, given in the fourth column is equal to the horizontal angle between the direction of the sun's rays and a normal to the wall or vertical surface in question.

The angle of incidence, *i*, is defined as the number of deg between the actual direction of the sun's rays and a normal to the surface. In order to obtain the numerical value of the angle of incidence, its cosine is first obtained, by trigonometry, as the product of the cosines of the angles *H* and *B*. The value of *i* is then read from trigonometric tables.

The next to the last column gives the normal intensity, I_0, which *is defined* — it will be quantitatively discussed in the next article of the series — as the number of Btu received in one hour, on a clear day, on one sq ft of surface located at sea level and *normal* to the direction of the sun's rays, that is, normal to the angle of incidence.

The last column of each table gives the product $I_0 \cos i$ which is the instantaneous rate in Btu pre hr of irradiation of unit area of south-facing wall or window. In using this value, the designer must remember that the term "irradiation" refers to the rate at which energy is impinging on the surface and is not necessarily indicative either of energy entering the structure through a window or of energy actually absorbed by an opaque wall. This irradiation rate is, however, the basic design term needed in evaluating either rate of transmission or rate of absorption.

---

*Associate Mechanical Engineer, California State Harbor Board.

**Professor of Mechanical Engineering, University of California.

TABLE 1a

South Wall — Latitude 30°

Solar Time	Solar Altitude H	Azimuth A	B = 180−A	cos H	cos B	cos i	i	Normal Intensity I_o	$I_o \cos i$
May									
6am, 6pm	10	73	107	0.9848	—	—	B is greater than 90° Sun is too far north to irradiate the surface		
7am, 5pm	22	79	101	0.9272	—	—			
8am, 4pm	36	86	94	0.8090	—	—	—	—	—
9am, 3pm	48	93	87	0.6691	0.0523	0.3499	69.52	273.4	9.57
10am, 2pm	61	103	77	0.4848	0.2250	0.1091	83.75	285.5	31.15
11am, 1pm	73	123	57	0.2924	0.5446	0.1592	80.84	291.3	46.37
12 Noon	80	180	0	0.1737	1.0000	0.1737	79.99	293.1	50.91
June									
6am, 6pm	13	70	110	0.9744	—	—	—	—	—
7am, 5pm	31	79	101	0.8572	—	—	—	—	—
8am, 4pm	37	82	98	0.7986	—	—	—	—	—
9am, 3pm	51	89	91	0.6293	—	—	—	—	—
10am, 2pm	63	97	83	0.4540	0.1219	0.0553	86.84	286.7	15.85
11am, 1pm	76	114	66	0.2419	0.4067	0.0984	84.35	292.2	28.75
12 Noon	84	180	0	0.1045	1.0000	0.1045	84.00	293.7	30.69
July									
6am, 6pm	10	72	108	0.9848	—	—	—	—	—
7am, 5pm	22	78	102	0.9272	—	—	—	—	—
8am, 4pm	36	85	95	0.8090	—	—	—	—	—
9am, 3pm	48	92	88	0.6691	0.0349	0.0234	88.66	273.4	6.39
10am, 2pm	61	102	78	0.4848	0.2079	0.1008	84.21	285.5	28.78
11am, 1pm	73	120	60	0.2924	0.5000	0.1462	81.60	291.3	42.59
12 Noon	80	180	0	0.1737	1.0000	0.1737	84.00	293.1	50.91
August									
6am, 6pm	7	79	101	0.9926	—	—	—	—	—
7am, 5pm	21	87	93	0.9336	—	—	—	—	—
8am, 4pm	32	94	86	0.8480	0.0698	0.0592	86.61	241.0	14.67
9am, 3pm	46	103	77	0.6947	0.2250	0.1563	81.00	270.4	42.26
10am, 2pm	57	116	64	0.5446	0.4384	0.2388	76.18	282.5	67.46
11am, 1pm	68	139	41	0.3746	0.7547	0.2827	73.56	289.4	81.81
12 Noon	72	180	0	0.3090	1.0000	0.3090	72.00	290.7	89.26
September									
6am, 6pm	5	89	91	0.9962	—	—	—	—	—
7am, 5pm	14	97	83	0.9703	0.1219	0.1183	83.20	157.0	17.40
8am, 4pm	26	105	75	0.8988	0.2588	0.2326	76.54	223.0	51.87
9am, 3pm	39	116	64	0.7772	0.4384	0.3407	70.08	258.9	88.21
10am, 2pm	49	130	50	0.6561	0.6428	0.4217	65.05	274.6	115.99
11am, 1pm	58	151	29	0.5299	0.8746	0.4635	62.39	283.3	131.30
12 Noon	61	180	0	0.4848	1.0000	0.4848	61.00	285.5	138.41

TABLE 2a

South Wall — Latitude 35°

Solar Time	Solar Altitude H	Azimuth A	B = 180−A	cos H	cos B	cos i	i	Normal Intensity I_o	$I_o \cos i$
May									
6am, 6pm	12	73	107	0.9782	—	—	—	—	—
7am, 5pm	23	81	99	0.9205	—	—	—	—	—
8am, 4pm	36	89	91	0.8090	—	—	—	—	—
9am, 3pm	49	99	81	0.6561	0.1564	0.1026	84.11	274.6	28.17
10am, 2pm	60	112	68	0.5000	0.3746	0.1873	79.29	284.8	53.34
11am, 1pm	70	135	45	0.3420	0.7071	0.2418	76.09	290.2	70.17
12 Noon	75	180	0	0.2588	1.0000	0.2588	75.00	291.9	75.54
June									
6am, 6pm	14	71	109	0.9703	—	—	—	—	—
7am, 5pm	26	78	102	0.8988	—	—	—	—	—
8am, 4pm	38	86	94	0.7880	—	—	—	—	—
9am, 3pm	51	95	85	0.6293	0.0872	0.0548	86.86	276.9	15.17
10am, 2pm	63	107	73	0.4540	0.2924	0.1327	82.37	286.7	38.04
11am, 1pm	73	129	51	0.2924	0.6293	0.1840	79.40	291.3	53.59
12 Noon	78	180	0	0.2079	1.0000	0.2079	78.00	292.7	60.85
July									
6am, 6pm	12	73	107	0.9782	—	—	—	—	—
7am, 5pm	22	80	100	0.9272	—	—	—	—	—
8am, 4pm	35	88	92	0.8192	—	—	—	—	—
9am, 3pm	47	97	83	0.6820	0.1219	0.0831	85.24	272.1	22.61
10am, 2pm	59	110	70	0.5150	0.3420	0.1761	79.84	284.1	50.03
11am, 1pm	70	133	47	0.3420	0.6820	0.2332	76.52	290.2	67.67
12 Noon	76	180	0	0.2419	1.0000	0.2419	76.00	292.2	70.68
August									
6am, 6pm	8	80	100	0.9903	—	—	—	—	—
7am, 5pm	19	88	92	0.9455	—	—	—	—	—
8am, 4pm	32	97	83	0.8480	0.1219	0.1034	84.07	241.0	24.92
9am, 3pm	44	108	72	0.7193	0.3090	0.2223	77.16	267.7	59.51
10am, 2pm	56	123	57	0.5592	0.5446	0.3045	72.27	281.6	85.75
11am, 1pm	64	145	35	0.4384	0.8132	0.3591	68.99	287.2	103.13
12 Noon	68	180	0	0.3746	1.0000	0.3746	68.00	289.3	108.37
September									
6am, 6pm	5	89	91	0.9962	—	—	—	—	—
7am, 5pm	14	98	82	0.9703	0.1392	0.1351	82.23	157.0	21.21
8am, 4pm	26	107	73	0.8988	0.2924	0.2628	74.23	223.0	58.60
9am, 3pm	39	119	61	0.7772	0.4848	0.3768	67.86	258.9	97.55
10am, 2pm	48	134	46	0.6691	0.6947	0.4648	62.30	273.4	127.08
11am, 1pm	55	154	26	0.5736	0.8988	0.5155	58.93	280.8	144.75
12 Noon	58	180	0	0.5299	1.0000	0.5299	58.00	283.3	150.12

TABLE 3a

South Wall — Latitude 40°

Solar Time	Solar Altitude H	Azimuth A	B = 180−A	cos H	cos B	cos i	i	Normal Intensity I_o	$I_o \cos i$
May									
6am, 6pm	13	74	106	0.9744	—	—	—	—	—
7am, 5pm	23	83	97	0.9205	—	—	—	—	—
8am, 4pm	35	93	87	0.8192	0.0523	0.0428	87.55	249.8	10.69
9am, 3pm	47	104	76	0.6820	0.2419	0.1650	80.50	272.1	44.90
10am, 2pm	57	119	61	0.5446	0.4848	0.2640	74.70	282.5	74.58
11am, 1pm	66	143	37	0.4067	0.7986	0.3248	72.05	288.3	93.64
12 Noon	70	180	0	0.3420	1.0000	0.3420	70.00	290.2	99.25
June									
6am, 6pm	15	72	108	0.9659	—	—	—	—	—
7am, 5pm	27	81	99	0.8910	—	—	—	—	—
8am, 4pm	38	90	90	0.7880	—	—	—	—	—
9am, 3pm	50	100	80	0.6428	0.1737	0.1117	83.59	275.8	30.81
10am, 2pm	61	115	65	0.4848	0.4226	0.2049	78.18	285.5	58.49
11am, 1pm	69	139	41	0.3584	0.7547	0.2705	74.30	289.8	78.39
12 Noon	74	180	0	0.2756	1.0000	0.2756	74.00	291.5	80.37
July									
6am, 6pm	13	74	106	0.9744	—	—	—	—	—
7am, 5pm	24	82	98	0.9136	—	—	—	—	—
8am, 4pm	36	92	88	0.8090	0.0349	0.0282	88.28	252.2	7.11
9am, 3pm	47	103	77	0.6820	0.2250	0.1535	81.17	272.1	41.77
10am, 2pm	58	118	62	0.5299	0.4695	0.2488	75.59	283.3	70.48
11am, 1pm	67	142	38	0.3907	0.7880	0.3079	72.06	288.9	88.95
12 Noon	71	180	0	0.3256	1.0000	0.3256	71.00	290.6	96.38
August									
6am, 6pm	9	81	99	0.9877	—	—	—	—	—
7am, 5pm	20	90	90	0.9397	—	—	—	—	—
8am, 4pm	31	100	80	0.8572	0.1737	0.1489	81.45	237.9	35.42
9am, 3pm	42	112	68	0.7431	0.3746	0.2784	73.84	264.4	73.61
10am, 2pm	52	128	52	0.6157	0.6157	0.3791	67.74	278.9	105.73
11am, 1pm	59	151	29	0.5150	0.8746	0.4504	63.22	284.1	127.96
12 Noon	63	180	0	0.4540	1.0000	0.4540	63.00	286.7	130.16
September									
6am, 6pm	5	89	91	0.9962	—	—	—	—	—
7am, 5pm	12	99	81	0.9782	0.1564	0.1530	81.20	133.5	20.42
8am, 4pm	24	110	70	0.9136	0.3420	0.3125	71.78	215.6	67.37
9am, 3pm	34	122	58	0.8290	0.5299	0.4393	63.95	247.0	108.51
10am, 2pm	42	137	43	0.7431	0.7314	0.5435	57.02	264.5	143.75
11am, 1pm	49	157	23	0.6561	0.9205	0.6039	52.85	274.6	165.83
12 Noon	51	180	0	0.6293	1.0000	0.6293	51.00	276.9	174.25

TABLE 4a

South Wall — Latitude 45°

Solar Time	Solar Altitude H	Azimuth A	B = 180−A	cos H	cos B	cos i	i	Normal Intensity I_o	$I_o \cos i$
May									
6am, 6pm	14	76	104	0.9703	—	—	—	—	—
7am, 5pm	25	86	94	0.9063	—	—	—	—	—
8am, 4pm	35	96	84	0.8192	0.1045	0.0856	85.09	249.8	21.38
9am, 3pm	45	109	71	0.7071	0.3256	0.2302	76.69	269.3	61.99
10am, 2pm	55	125	55	0.5736	0.5736	0.3290	70.80	280.8	92.38
11am, 1pm	62	149	31	0.4695	0.8572	0.4025	66.28	286.1	115.15
12 Noon	65	180	0	0.4226	1.0000	0.4226	65.00	287.8	121.62
June									
6am, 6pm	16	73	107	0.9613	—	—	—	—	—
7am, 5pm	27	83	97	0.8910	—	—	—	—	—
8am, 4pm	38	94	86	0.7880	0.0698	0.0550	86.85	256.7	14.11
9am, 3pm	48	106	74	0.6691	0.2756	0.1844	79.36	273.4	50.41
10am, 2pm	58	122	58	0.5299	0.5299	0.2808	73.70	283.3	79.55
11am, 1pm	65	146	34	0.4226	0.8290	0.3503	69.50	287.8	100.81
12 Noon	69	180	0	0.3584	1.0000	0.3584	69.00	289.8	103.86
July									
6am, 6pm	14	75	105	0.9703	—	—	—	—	—
7am, 5pm	25	85	95	0.9063	—	—	—	—	—
8am, 4pm	35	95	85	0.8192	0.0872	0.0714	85.90	249.8	17.84
9am, 3pm	46	108	72	0.6947	0.3090	0.2147	77.60	270.4	58.05
10am, 2pm	54	124	56	0.5878	0.5592	0.3287	70.81	279.9	92.00
11am, 1pm	63	148	32	0.4540	0.8481	0.3850	69.20	286.7	110.37
12 Noon	66	180	0	0.4067	1.0000	0.4067	66.00	288.4	117.29
August									
6am, 6pm	9	81	99	0.9877	—	—	—	—	—
7am, 5pm	20	92	88	0.9397	0.0349	0.0328	88.12	196.3	6.44
8am, 4pm	30	103	77	0.8660	0.2250	0.1949	78.76	235.1	45.82
9am, 3pm	40	116	64	0.7660	0.4384	0.3358	70.39	260.4	87.44
10am, 2pm	49	133	47	0.6561	0.6820	0.4475	63.42	274.6	122.88
11am, 1pm	55	154	26	0.5736	0.8988	0.5156	58.96	280.8	144.78
12 Noon	58	180	0	0.5299	1.0000	0.5299	58.00	283.3	150.12
September									
6am, 6pm	5	89	91	0.9962	—	—	—	—	—
7am, 5pm	11	100	80	0.9816	0.1737	0.1705	80.19	117.0	19.95
8am, 4pm	22	112	68	0.9272	0.3746	0.3473	69.68	207.2	71.96
9am, 3pm	31	125	55	0.8572	0.5736	0.4917	60.55	237.9	140.76
10am, 2pm	39	140	40	0.7772	0.7660	0.5953	53.47	258.9	154.25
11am, 1pm	44	159	21	0.7193	0.9336	0.6715	48.82	267.7	179.76
12 Noon	46	180	0	0.6947	1.0000	0.6947	46.00	270.7	188.05

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL SECTION

The object of the Society is to advance the arts and sciences of heating, ventilating, cooling and air conditioning, and the allied arts and sciences, for the benefit of the general public, to encourage and conduct scientific research, and to cooperate with other organizations having the same or similar objectives.

Effects of Room Size and Non-Uniformity of Panel Temperature on Panel Performance

By L. F. Schutrum* and J. D. Vouris†, Cleveland, Ohio

This paper is the result of research carried on by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS at its Research Laboratory located at 7218 Euclid Ave., Cleveland 3, Ohio

SEVERAL YEARS ago, a special room was constructed at the ASHVE Research Laboratory for the study of heat transfer within a panel heated space. This room, commonly referred to as the Environment Laboratory, is approximately 12 ft wide and 24½ ft long, and the ceiling is adjustable to any height up to 12 ft. Either the floor or the ceiling, or both, may be heated, and all six surfaces may be cooled to any temperature or combination of temperatures desired. Cooled air can be introduced at six locations in the room to simulate infiltration. A detailed description of the construction and instrumentation of this room is given in an earlier paper.[1]

SUMMARY—Heat exchanges in floor and ceiling panel heated rooms have been discussed in a series of papers dealing with uniform temperature environments, and the modifying effects of non-uniform environments, room furnishings, and carpeting.

This paper reports the results of work done in the Environment Laboratory to evaluate the effects of room size and non-uniformity of panel surface temperature on panel performance.

Panel outputs and room air temperatures as previously reported were found to be applicable for design purposes. However, for non-uniform panel temperature conditions, the area weighted average panel temperature must be used.

In December 1952, a paper[2] was published giving the results of tests made in the Environment Laboratory with a heated ceiling, uniform environment (all surfaces other than the heated ceiling at a uniform temperature), and with and without simulated infiltration. In June 1953, a second paper[3] was presented, giving the results of a similar series of tests made with a heated floor. In a more recent paper,[4] the modifying effects of non-uniform environment, room furnishings, and carpeting were discussed.

All of the results presented in previous papers were obtained in a room 24½ ft long and 12 ft wide with an 8 ft ceiling height, and with either the entire floor or ceiling heated. The room with these dimensions will hereafter be referred to as the *standard room.* The tests reported in this paper were made to determine the effects of room size, and heating only portions of the floor or ceiling area on panel heat output and room air temperature. All tests were made with the room unfurnished and unlighted.

---

*Research Fellow, ASHVE Research Laboratory. Junior Member of ASHVE.

†Assistant Research Engineer, ASHVE Research Laboratory.

[1] Exponent numerals refer to References.

Presented at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Swampscott, Mass., June 1954.

JOURNAL SECTION

Effect of Room Size on Panel Performance

Test Methods: Since the temperature of all six room surfaces could be controlled directly, it was experimentally expedient to fix these temperatures and observe the resulting dependent variables, room air temperature and panel output. As will be shown later, from these observed interrelationships of room air temperature, panel output, and surface temperatures, the performance of a panel in a room of known thermal properties can be deduced for any combination of inside and outside air temperatures.

To determine the effect of room size on panel heat output and room air temperature, rooms of three sizes other than the *standard room* were tested. First, the ceiling of the *standard room* was raised to create a room 24½ × 12 × 12 ft high. Second, a smaller room 12 ft square with an 8 ft ceiling height was made by installing a temporary partition across the larger room. Although the temperature of this partition could not be directly controlled, heat flow meters and thermocouples located on the wall surfaces provided adequate information regarding its thermal conditions.

For each of these two room sizes, complete series of tests were made with various combinations of ceiling or floor panel surface temperatures, unheated room surface temperatures, and infiltration air quantity and temperature.

A few tests were also made in a 24½ × 12 ft room with a 4 ft ceiling. This, of course, was not a practical room height, but provided the same geometrical proportions as a room 49 × 24 × 8 ft high. However, a complete simulation of heat transfer was not obtained.

Effect of Room Size on Ceiling Panel Performance: The results of tests with ceiling panels in the rooms just described, are presented in Table 1. Column 1 of the table gives the general test conditions. Columns 3 to 8 inclusive show the observed temperatures of the six room surfaces. The area weighted average unheated surface temperature (AUST) for each test is given in column 9. Air changes per hour and the entering infiltration air temperatures are listed in columns 10 and 11.

The observed outputs per square foot of the heating panel are listed

Table 1—Observed Ceiling Panel Outputs and Room Air Temperatures for Three Room Sizes
Calculated Values for a Room 24½ x 12 x 8 Ft High Shown for Comparison
Entire Ceiling Area Heated

General Test Conditions	Test No.	Room Surface Temperatures, F						AUST[a]	Infiltration		Panel Output Btu/(hr)(sq ft)		Room Air Temperature, F			
		Ceiling	Floor	North Wall	South Wall	East Wall	West Wall		Changes per hour	Temp F	Observed	Calculated[b]	Observed		Calculated[c]	
													30 in.	60 in.	30 in.	60 in.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Room Size 12 ft x 12 ft x 8 ft high																
Uniform Environment	332	119.8	65.3	65.8	65.4	65.5	65.4	65.4	—	—	59.5	59.5	67.3	68.9	67.5	69.8
	334	110.7	62.1	62.4	62.9	62.9	62.7	62.6	—	—	50.0	51.5	64.5	66.1	64.5	66.4
	339	120.3	64.4	64.8	64.8	64.8	64.7	64.7	3.0	19.9	61.5	64.0	59.0	62.1	55.8	60.2
One Wall Neutral (North)	287	120.2	64.7	77.3	65.6	65.5	65.6	67.4	—	—	58.5	59.0	68.6	72.0	69.5	71.6
	293	119.5	65.2	75.8	65.3	65.3	65.3	67.2	2.1	42.0	57.5	59.5	65.3	69.2	65.0	67.2
	294	120.4	65.3	75.6	65.4	65.5	65.5	67.3	3.0	40.3	59.0	61.5	63.6	67.8	62.8	65.2
	299	110.3	64.3	74.7	64.5	64.7	64.5	66.3	—	—	45.5	47.5	67.5	70.8	68.0	69.8
One Wall Neutral (North) One Wall Cold, (East)	288	120.2	65.3	71.6	65.4	35.4	65.5	61.1	—	—	63.0	65.0	61.4	66.8	63.4	65.8
	298	120.3	64.3	69.8	64.6	33.5	64.6	59.8	3.0	40.4	64.5	68.0	58.6	62.5	57.4	59.6
3 Simulated Windows[d] 2 Simulated Outside Walls, Floor, North & West Walls Neutral	289	120.0	82.4	85.2	66.4	66.6	83.5	74.7	—	—	48.0	51.5	76.3	80.0	76.5	78.3
	292	119.9	78.7	82.2	68.1	68.2	79.9	72.9	2.1	42.0	51.5	55.0	70.2	74.5	69.5	71.8
Room Size 24½ ft x 12 ft x 12 ft high																
Uniform Temperature Environment	301	119.9	64.2	66.7	64.8	64.6	64.3	64.7	—	—	60.0	60.5	66.2	67.3	66.8	69.1
	302	119.8	54.7	57.6	55.3	54.7	55.1	55.2	—	—	69.0	70.0	56.7	57.8	57.7	60.4
	303	120.0	74.1	76.5	75.0	75.4	74.9	75.0	—	—	49.5	51.5	76.5	77.5	76.8	78.6
	304	119.6	64.4	67.1	65.3	65.3	65.2	65.3	1.5	40.4	60.0	61.5	62.1	64.2	64.5	66.8
	309	100.6	65.0	66.5	65.0	65.3	64.8	65.2	—	—	37.0	37.0	66.0	66.8	66.6	68.0
	310	120.4	64.3	66.5	64.9	65.0	64.8	64.9	1.9	40.6	62.5	63.5	60.5	62.4	63.4	65.7
One Long Cold Wall	314	119.7	64.1	64.8	64.9	34.5	64.4	56.9	1.5	20.4	69.0	70.5	51.5	54.5	54.9	58.0
	315	120.5	64.4	65.6	65.2	35.2	64.8	57.4	—	—	68.0	68.5	57.5	59.0	59.9	62.4
3 Simulated Windows[d] 2 Simulated Outside Walls, Floor, North, & West Walls Neutral	316	120.3	79.8	82.0	67.4	67.4	80.7	74.0	—	—	50.5	53.0	73.8	74.9	75.8	77.7
	317	120.9	71.8	75.1	67.3	67.3	74.7	69.6	1.5	20.7	57.0	60.5	61.0	64.8	65.6	69.1
Room Size 24½ ft x 12 ft x 4 ft high																
Uniform Environment	324	120.7	65.0	67.7	64.8	64.8	64.8	65.1	—	—	60.0	61.5	73.7		67.3	
	325	110.9	64.9	66.9	64.5	64.4	64.5	64.9	—	—	48.0	49.0	71.8		66.7	

[a] Area weighted average temperature for the floor and four walls.
[b] Determined from Figs. 1 and 4 of Reference 2 for the same AUST, panel temperature, infiltration temp. and number of air changes per hour in *standard room*.
[c] Determined from Figs. 7 and 9 of Reference 2 for the same AUST, panel temperature, infiltration temp. and number of changes per hour in *standard room*.
[d] Simulated windows 4 ft x 5 ft with temperatures approximately 33 F.

in column 12; and in column 13, listed for comparison, are the heat outputs which would have been obtained in the *standard room.* These latter panel outputs were predicted from heat flow and surface temperature relationship curves given in Figs. 1 and 4 of Reference 2, and are for a uniform environment having the same AUST, panel temperature, air changes per hour, and infiltration air temperatures.

An analysis of the values in columns 12 and 13 indicates that the *average* ceiling panel output in the 12 × 12 × 8 ft room was approximately 4 percent lower than in the *standard room* with comparable but uniform environmental conditions. The *maximum* difference was just over 7 percent. Similarly, the *average* panel output in the 24½ × 12 × 12 ft room was about 2 percent lower than in the *standard room* and the *maximum* difference was approximately 6 percent. The greater difference occurred with greater deviations from uniform environment.

The observed air temperatures taken at the center of the rooms 30 in. and 60 in. above the floor are given in columns 14 and 15 of Table 1. In the next two columns are comparable air temperatures determined from Figs. 7 and 9 of Reference 2. These are the air temperatures which would have prevailed in the *standard room* with a uniform environment having the same AUST, panel temperature, and infiltration air changes and temperature. Since all of the values in columns 16 and 17 are for uniform environment conditions, only the values for uniform environment tests in columns 14 and 15 are strictly comparable with them. However, good agreement exists for all tests and all are included in the following discussion of the air temperature data.

An analysis of the air temperatures at the 30-in. level in the 12 × 12 × 8 ft room and the *standard room* indicates an average difference (neglecting the sign) of less than a degree and a maximum difference of 3.2 deg. At the 60-in. level, the average difference was 1.6 deg; the maximum difference was 2.9 deg; and in all but two tests, the observed temperatures were higher in the smaller room.

A similar analysis of the air temperatures at the 30-in. level in the 24½ × 12 × 12 ft room and the *standard room* indicates an average

Table 2—Observed Floor Panel Heat Outputs and Room Air Temperatures for Three Room Sizes
Calculated Values for a Room 24½ x 12 x 8 Ft High Shown for Comparison
Entire Floor Area Heated

General Test Conditions	Test No.	Room Surface Temperatures, F						AUST[a]	Infiltration		Panel Output Btu / (hr)(sq ft)		Room Air Temperature, F			
													Observed		Calculated[c]	
		Floor	Ceiling	North Wall	South Wall	East Wall	West Wall		Changes per hour	Temp F	Observed	Calculated[b]	30 in.	60 in.	30 in.	60 in.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Room Size 12 ft x 12 ft x 8 ft high																
Uniform Environment	333	85.6	64.6	64.7	65.0	65.0	64.9	64.8	—	—	29.5	29.0	69.7	69.5	71.8	71.5
	335	90.6	65.0	64.4	65.1	65.1	65.2	65.0	—	—	38.0	36.5	71.4	71.8	73.7	73.2
	340	85.9	65.1	64.7	64.4	64.6	64.5	64.7	3.1	21.0	41.0	41.5	64.8	65.5	64.2	64.3
One Wall Neutral (North)	285	85.0	64.8	70.7	65.1	64.2	65.2	65.9	—	—	27.0	26.5	70.5	70.5	72.4	72.0
	295	84.9	65.0	69.5	64.6	64.4	64.6	65.5	3.0	40.4	32.0	33.0	66.9	67.4	67.2	67.3
	296	85.0	64.8	70.2	65.0	64.8	64.9	65.8	2.1	40.4	31.0	31.0	68.5	68.5	68.9	68.9
	300	90.4	65.1	72.5	64.7	64.7	64.8	66.2	—	—	36.0	35.0	72.4	72.4	74.4	74.0
One Wall Cold (East)	286	86.6	65.0	66.2	64.4	33.6	64.4	59.4	—	—	40.5	38.0	67.2	67.2	68.6	68.1
	297	84.8	64.9	65.2	64.2	34.1	64.2	59.2	1.2	40.75	40.5	37.5	65.2	65.3	66.3	66.0
3 Simulated Windows[d] 2 Simulated Outside Walls, Ceiling, North & West Walls Neutral	290	85.0	74.5	73.9	67.4	67.4	73.7	68.9	—	—	24.5	22.5	73.1	73.5	74.3	74.1
	291	84.6	73.7	72.4	67.1	67.1	72.1	68.0	2.1	39.9	29.0	27.0	68.3	70.0	70.0	70.0
Room Size 24½ ft x 12 ft x 12 ft high																
Uniform Environment	305	95.1	64.9	67.5	64.9	64.4	64.9	65.1	—	—	46.5	43.5	73.2	73.2	75.2	74.7
	306	85.0	64.2	66.5	64.4	64.5	64.4	64.7	—	—	29.5	28.0	70.1	70.1	71.6	71.2
	307	84.9	55.0	58.0	55.3	54.9	55.2	55.4	—	—	43.5	41.0	63.1	63.0	65.4	64.8
	308	85.9	73.7	75.6	74.4	74.1	74.4	74.3	—	—	17.0	16.0	77.5	77.2	78.2	78.0
	311	85.6	64.6	66.3	64.4	64.6	64.4	64.7	1.5	40.3	34.0	32.0	67.5	67.1	69.5	69.2
One Long, Cold Wall (East)	312	85.3	64.7	65.7	64.7	33.9	64.6	57.1	—	—	44.5	39.5	64.3	64.2	66.6	66.1
	313	84.9	64.9	64.6	64.3	33.7	64.1	56.8	1.5	21.5	49.5	44.5	58.7	60.4	63.1	62.8
3 Simulated Windows[d] 2 Simulated Outside Walls, Ceiling, North & West Walls Neutral	318	85.9	73.5	73.2	66.9	67.0	72.3	69.1	—	—	27.0	23.5	73.6	73.3	74.8	74.5
	319	85.0	71.4	69.5	67.0	67.2	69.3	67.4	1.5	20.9	34.0	31.0	65.8	67.2	69.4	69.3
	320	85.9	71.9	70.0	66.5	66.6	69.6	67.5	1.5	20.2	35.0	31.5	66.1	67.1	69.6	69.6
	321	86.6	74.6	74.3	67.0	67.2	73.2	69.6	—	—	26.0	24.0	73.7	73.6	75.3	75.0
Room Size 24½ ft x 12 ft x 4 ft high																
Uniform Environment	322	85.5	64.8	66.7	64.4	64.5	64.4	64.8	—	—	27.5	29.0	73.6	—	71.8	71.4
	323	95.3	64.8	66.7	64.3	64.5	64.4	64.8	—	—	42.5	44.0	77.5	—	75.1	74.6

[a] Area weighted average temperature of the ceiling and four walls.
[b] Determined from Figs. 1 and 4 of Reference 3 for the same AUST, panel temperature, infiltration temperature, and no. of air changes per hr. in *standard room.*
[c] Determined from Figs. 7 and 10 of Reference 3 for the same AUST, panel temperature, infiltration temperature, and no. of air changes per hr. in *standard room.*
[d] Simulated windows 4 ft x 5 ft with temperatures approximately 33 F.

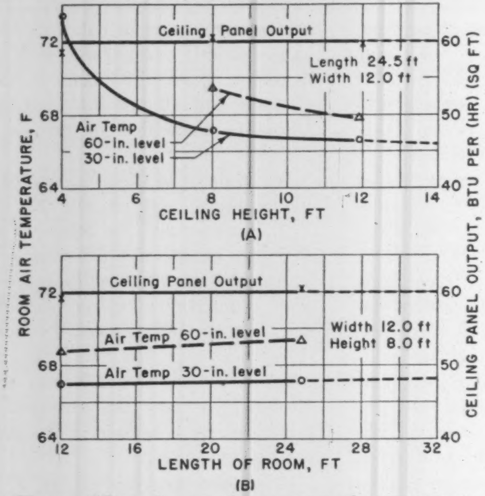


Fig. 1—Effect of room size on room air temperature and ceiling panel output

Uniform environment, no infiltration, ceiling 120 F AUST 65 F

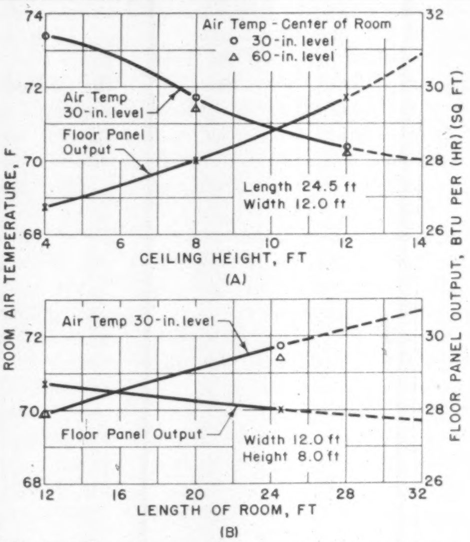


Fig. 2—Effect of room size on room air temperature and floor panel output

Uniform environment, no infiltration, floor 85 F AUST 65 F

difference of 2.0 deg and a maximum difference of 4.6 deg. At the 60-in. level, the average difference was 2.7 deg and the maximum difference was 4.3 deg. In all tests, the higher temperatures occurred in the *standard room.*

Fig. 1 indicates the trend of the effects of ceiling height and room length on unit output and room air temperature for ceiling panel heated rooms with a uniform environment and without infiltration. These curves were plotted from tests of a limited number of conditions and should be considered therefore as illustrative only.

For the rooms with lower ceilings, the room air temperature is higher. This is expected, since the ratio of heated surface area to unheated surface area is higher with lower ceilings. The air temperature in the 24½ ft long room is slightly higher than in the 12 ft long room for a constant ceiling height (Diagram B of Fig. 1). This also may be attributed in part to the higher ratio of heated to unheated areas. Higher ceiling panel outputs were expected in the rooms with lower air temperatures; however, since this was not observed, the increased convection output of the ceiling panel must have been so small as to be masked by experimental errors.

The analysis given, taking into account the unavoidable inaccuracies in determining the AUST, seems to indicate that with ceiling panel systems, the effect of room size and ceiling height on panel output and room air temperature may be safely neglected in rooms of normal size and proportions.

Effect of Room Size on Floor Panel Performance: Table 2, which is similar in construction to Table 1, presents data obtained on floor panel heated rooms of sizes described. The values in columns 13, 16 and 17 were obtained from Figs. 1, 4, 7, and 10 of Reference 3. The experimental air temperatures for the non-standard test rooms in columns 14 and 15, compared with those for the *standard room* in columns 16 and 17, show close agreement.

A comparison of the values in columns 12 and 13 shows the differences in the observed panel heat outputs and the heat outputs which would have been obtained in the *standard room*, under the conditions specified in the footnotes of the table. The average difference (regardless of sign) between the observed heat outputs for the 12 × 12 × 8 ft room and those for the *standard room* is 4 percent and the maximum difference is 8.2 percent.

The observed panel outputs for the 24½ × 12 × 12 ft room compared with those for the *standard*

Table 3—Comparison of Calculated Panel Performance Using Standard Room Heat Transfer Relationships vs. Observed Performance

	Test No. 318	Basis of Comparison	
		Fixed Room Air Temp & Cond[a]	Fixed Panel Temp and AUST
	Observed	From Example	From Table 2
1	2	3	4
Air Temp (60-in. level)	73.3	73.3	74.5
Panel Output, Btu/(hr)(sq ft)	27.0	26.1	23.5
Panel Temp, F	85.9	86.2	85.9
AUST, F	69.1	67.2	69.1
Panel Temp minus AUST, F deg	16.8	19.0	16.8
C[a], Btu/(hr)(sq ft)(F deg inside surface to outside air)	0.10	0.10	—

[a] Wall and ceiling conductance for zero F outdoor temperature.

room show greater divergence. The average difference for all tests is approximately 8 percent; the average difference for the tests with non-uniform environment is 10.1 percent, and the maximum difference is 13 percent. In all cases, the observed outputs were higher than for the *standard room.*

As indicated for ceiling panels, room air temperatures in a floor panel heated room also appear to vary directly with changes in the ratio of heated to unheated areas resulting from different room sizes (see Fig. 2). Furthermore, convective heat transfer from the panel would be expected to increase with a decreased ratio of heated to unheated areas and cause a lower room air temperature and an increased air motion. These trends in panel output shown in Diagrams A and B of Fig. 2 are primarily due to the convective component, which is important in floor panel heating.

At first glance, the differences shown in Table 2 seem to be serious, but it should be noted that these differences would be appreciably reduced if, as in actual practice, comparisons were made on the basis of the same room air temperature rather than the same AUST and panel temperature. Since not all variables can be controlled independently, in a comparison on the basis of equal air temperature the panel temperature, panel output, and AUST must be adjusted.

The room heat balance must be satisfied. This is expressed by the formula:

$$C \times (\text{AUST} - t_o) \times (\text{unheated surface area}) = (\text{panel output}) \times (\text{panel area}) \ldots (1)$$

where

C = average wall and ceiling conductance, Btu per (hr) (sq ft) (F deg inside surface to outside air)

t_o = outside air temperature, Fahrenheit

The relationship between room air temperature, AUST, and panel temperature must also be satisfied. This relationship (see Fig. 7, Reference 3) is given by the formula:

$$\text{room air temp} = 0.32 \times (\text{panel temp} - \text{AUST}) + \text{AUST} \ldots (2)$$

For test No. 318, for instance, in which the difference between the observed and the calculated unit heat output was greatest, the comparison on the basis of equal room air temperatures would proceed as follows:

From test No. 318

Room Size	24-1/2 × 12 × 12 ft
Room air temperature (60-in. level)	73.3 F
AUST	69.1 F
Unheated-surface area	1174 sq ft
Floor panel area	300 sq ft
Heat output per sq ft of panel area	27.0 Btu per hr

Average heat loss through the unheated surface area = 300 × 27/1174 = 6.9 Btu per sq ft.

Any combination of conductance C (wall and ceiling) and temperature difference (AUST minus assumed outside temperature), the product of which would equal 6.9, could be thought of as simulating the unheated area of the Environment Laboratory during test No. 318. If an outside temperature of zero is assumed, the temperature difference is AUST—0 F or 69.1 deg. Then the C value for the wall and ceiling would be 6.9/69.1 = 0.1 Btu per (hr) (sq ft) (F deg).

The problem now becomes one of finding the proper combination of AUST, panel temperature, and panel heat output which will maintain a

Table 4—Observed Panel Outputs and Room Air Temperatures For Ceiling and Floor Panels at Non-Uniform Temperatures
Calculated Values for Panels at Uniform Temperature Shown for Comparison (Room Size 24½ x 12 x 8 Ft)

Area of Heated Panel Percent	Test No.[a]	Temperature Environment	Observed Panel Temperature F			AUST	Infiltration		Panel Output Btu per(hr)(sq ft)					Room Air Temperature, F			
									Observed			Calculated		Experimental		Calculated[g]	
			Heated	Unheated[c,g]	Avg[d]		Changes per hour	Temperature F	Heated	Unh'ted	Avg[e]	Heated[f]	Avg[g]	30 in.	60 in.	30 in.	60 in.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
								Ceiling Panel									
33C[a]	358	Uniform	119.9	72.4	87.9	64.3	none	—	64.8	4.4	24.2	61.2	23.6	65.6	66.7	65.2	66.2
49C	361		119.9	73.2	96.1	64.3	none	—	64.4	2.5	32.8	61.2	32.8	65.8	67.3	65.5	66.8
49A	344		119.9	79.5	99.3	64.8	none	—	65.7	8.1	36.4	60.6	36.0	66.5	68.4	66.2	67.6
49A	345		119.8	77.7	98.3	64.5	1	20.0	66.9	6.7	36.2	62.4	36.2	62.3	64.7	62.2	64.4
49A	346		119.1	76.8	97.5	64.5	2	20.0	66.9	6.4	36.0	62.4	35.6	57.8	61.4	58.5	61.3
49A	347		119.1	76.2	97.2	64.4	2¾	20.2	67.3	6.3	35.9	62.8	35.7	56.0	59.3	55.7	59.0
33C	359	Non-Uniform[b]	119.3	67.5	84.5	56.7	none	—	73.2	3.5	26.3	67.1	26.5	58.2	60.9	57.9	59.5
49C	360		119.3	70.3	94.4	56.9	none	—	71.1	3.6	36.7	67.1	37.0			58.5	60.6
								Floor Panel									
33C	352	Uniform	85.4	66.8	72.9	64.7	none	—	30.8	2.0	11.4	28.8	10.8	67.2	67.3	67.5	67.4
49C	353		85.5	66.5	75.9	64.4	none	—	30.7	1.2	15.7	29.7	15.5	68.2	68.2	68.3	68.2
65C	354		85.0	66.9	78.7	64.3	none	—	29.8	0.8	19.7	29.2	19.5	69.2	69.2	69.3	69.0
49A	348		85.1	68.4	76.6	64.4	none	—	30.5	2.7	16.3	29.1	16.6			68.6	68.4
49A	349		85.8	67.1	76.3	64.9	1	20.7	36.8	2.3	18.8	33.3	18.8	65.7	66.0	66.2	66.2
49A	350		85.3	65.5	75.2	64.4	2	20.2	41.6	2.9	21.8	37.1	21.4	62.6	62.8	63.0	63.3
49A	351		85.3	64.5	74.7	64.4	2¾	20.8	43.6	3.1	23.0	40.3	23.6	60.3	61.1	61.0	61.4
33C	355	Non-Uniform	85.2	60.9	69.7	57.4	none	—	50.5	1.9	17.8	39.5	17.8	61.1	61.9	61.0	61.1
49C	356		84.5	62.9	73.5	57.1	none	—	45.7	0.7	22.8	39.3	23.4	62.4	62.4	62.2	62.4
65C	357		85.3	63.5	77.7	57.9	none	—	43.6	—0.5	28.3	39.3	28.2	64.0	64.0	64.1	64.3

C—Consecutive Panels; A—Alternate Panels Heated.

[b] One Long Wall 32 F; Other Unheated Surfaces 65 F.

[c] Neither Heated nor Cooled by Liquid Circulation—Neutral.

[d] Area Weighted Average of Columns 4 and 5.

[e] Area Weighted Average of Columns 10 and 11.

[f] For Test Conditions Given in Columns 3, 7, 8, 9 and Entire Panel Area at Temperature Given in Column 4.

[g] For Test Conditions Given in Columns 3, 7, 8, 9 and Entire Panel Area at Temperature Given in Column 6.

room air temperature of 73.3 F when the average conductance of the ceiling and walls is 0.10, and the outside temperature is 0 F. The room size is the same as that used in Test No. 318. Equation 1 then becomes

$$0.1 \times (\text{AUST} - 0) \times (1174) = (\text{Panel heat output}) \times 300$$

and Equation 2 becomes

$$73.3 = 0.32 \times (\text{Panel temp} - \text{AUST}) + \text{AUST}$$

Since the two equations contain three unknowns, a trial and error method is indicated for their solution. Substituting corresponding values from Figs. 1 and 7 of Reference 3, the results shown in column 3 of Table 3 are found to satisfy both equations. For comparison, the actual observed values for test No. 318 are listed in column 2 and the calculated values from column 13 of Table 2 are given in column 4 of Table 3. It is evident from Table 3 that when the relatively slight corrections in AUST and panel temperature, necessary to maintain a 73.3 F room temperature, are made, good agreement in panel heat output is obtained. It may therefore be concluded that the heat flow and air temperature relationships developed in Reference 3 may be used without correction for designing panels for rooms of normal size and proportions. There is some evidence that the output of a floor panel increases slightly with ceiling height because of increased convection, and corrections may be necessary for ceilings exceeding the 12-ft height covered in the experiments.

Effect of Non-Uniformity of Panel Temperature on Panel Performance

Test Methods: As described in a previous paper,[1] all of the interior surfaces of the Environment Laboratory consist of a number of metal sub-panels of various sizes which can be heated or cooled by liquid circulated through them. The 24½ ×12 ft floor of the room is divided by a 6-in. wide × 12 ft long sub-panel into two 12 ft square areas, each covered by six 2 × 12 ft sub-panels laid with their long dimension parallel with the long dimension of the room. Each of these sub-panels is separately connected to the circulating system, and each connection is valved so that any sub-panel or combination of sub-panels may be heated or be shut off. The arrangement of sub-panels on the ceiling is the same as described above for the floor.

In the tests to be discussed, the valves to selected sub-panels were closed, so that the total heated area was less than the total area of the ceiling or floor surface. The valved-off sub-panels were neither heated nor cooled by liquid circulation, but reached an equilibrium temperature which resulted from the combined effects of radiative and convective heat exchange within the enclosure, the heat loss or gain from or to the back of the panels, and the heat conducted to the panels through piping and panel supports, and from adjacent heated panels. In all tests, the equilibrium temperature attained by these panels was high enough so that some heat was given off from them to the space.

Results reported here on this part of the program were made in the standard sized room. Similar results were obtained for rooms of two other sizes. Two general arrangements of heated panels were used. In some tests, the heated panel area was made up of *consecutively* located sub-panels 24 ft in length, starting at the east wall and extending as far across the floor or ceiling as desired. In other tests, alternate sub-panels were heated. In these tests, the first row of sub-panels along the east wall was heated; the second row was unheated, etc. In all cases, the 6 in. × 12 ft sub-panel was unheated.

Results with Non-Uniform Panel Temperatures: The results obtained in tests with only part of the ceiling or floor areas heated are tabulated in Table 4. Column 1 of Table 4 gives the percentage of the ceiling or floor area which was heated. The letters A or C appearing after the percentage values indicate *alternate* or *consecutive* arrangements of heated sub-panels. Column 3 indicates whether the environment was uniform or non-uniform. Columns 4 to 9 inclusive give the test conditions.

The observed panel heat outputs are tabulated in columns 10, 11 and 12 of Table 4. The values in column 10 are the heat outputs of the heated sub-panels at the observed temperatures listed in column 4. Similarly, column 11 gives the outputs of the unheated sub-panels at the temperatures in column 5. The values in column 12 are the area weighted average heat outputs of the entire ceiling or floor area, and the observed area weighted average surface temperatures are listed in column 6.

For comparison with the observed values in column 10, column 13 gives the calculated panel heat outputs which would have been obtained in the room with the same AUST and infiltration conditions which prevailed in the tests but with the *entire* ceiling or floor area heated to the temperature of the heated sub-panels shown in column 4. Similarly, the calculated heat outputs in column 14 are for the same AUST and infiltration conditions used in the tests but with the entire ceiling or floor area heated to the average temperature given in column 6. The values in columns 13 and 14 are based on data in References 2, 3 and 4.

Measured outputs from heated sub-panels given in column 10, Table 4, are higher in all tests than the corresponding calculated outputs shown in column 13. These greater outputs occurred for two reasons. First, and probably most important, when only a part of the ceiling was heated, the room air temperature was lower and the convection component of heat output was therefore increased. The second reason may be found in the fact that variations in ceiling temperature in themselves set up localized convection which tends to increase the convection output of the heated surfaces.

Certain trends may also be found by a comparison of the values in columns 10 and 13 of Table 4. It may be seen that the heat output per square foot of panel increases with a decrease in the percentage of the total floor or ceiling area that is heated. Heat outputs are also greater for alternately than for consecutively arranged heated areas, and for non-uniform than uniform environments. All of these increases are greater for floor panels than for ceiling panels. A more complete analysis of these involved relationships has been postponed until current work on the separation of the convective and radiative components of panel output have been completed. In contrast to the comparatively large differences between the values given in columns 10 and 13, the observed average heat outputs given in column 12 agree very well with the calculated average outputs in column 14. It is also significant that the observed air temperatures given in columns 15 and 16 are in excellent agreement with the calculated temperatures listed in the last two columns. It is therefore evident that the relationships between panel heat output and AUST, air temperature and panel surface temperature, as developed in References 2, 3 and 4 for panels of uniform temperature, also apply to average panel temperatures and average heat outputs when the panels are not at a uniform temperature.

This concept of treating the entire ceiling or floor as a unit may be advantageous. For example, suppose that conditions were such that the entire ceiling area at 100 F would give a total heat output equal to the room heat loss. On the assumption that the unheated part of the ceiling in the room under consideration is 70 F, any number of solutions would be possible as long as the area weighted average temperature of the entire ceiling is 100 F. If the heated portion of the ceiling were 120 F, the required panel area would be 60 percent of the ceiling area. If it were desirable to use 75 percent of the ceiling area for the heated panel, its surface temperature should be 110 F.

Conclusions

1. The effects of room size on the performance of floor and ceiling panels are relatively small so that the heat transfer relationships developed in the *standard room* and reported in References 2, 3 and 4, may safely be used without correction for the design of panel heating systems for any space of normal size and proportion.

2. Within the range of conditions tested, ceiling or floor panels comprised of heated and unheated sections have the same total heat output and produce the same room air temperature as if the entire area were heated to a uniform temperature equal to the area weighted average of the heated and unheated surfaces. The maximum test temperatures of the heated portions of floor and ceiling panels were 95 F and 140 F respectively.

Contemplated Work on Panel Heating

Work is currently in progress at the Laboratory to develop simplified procedures for the design of floor and ceiling panel heating systems. Concurrently, additional work is being done in the Environment Laboratory to evaluate separately the convective and radiative components of heat transfer from heating panels.

References

1. ASHVE Research Report No. 1444—The ASHVE Environment Laboratory, by Cyril Tasker, C. M. Humphreys, G. V. Parmelee and L. F. Schutrum (ASHVE Transactions, Vol. 58, p. 139).
2. Heat Exchanges in a Ceiling Panel Heated Room, by L. F. Schutrum, G. V. Parmelee and C. M. Humphreys (ASHVE Journal Section, *Heating, Piping & Air Conditioning*, December 1952, p. 123).
3. Heat Exchanges in a Floor Panel Heated Room, by L. F. Schutrum, G. V. Parmelee and C. M. Humphreys (ASHVE Journal Section, *Heating, Piping & Air Conditioning*, July 1953, p. 133).
4. Effects of Non-Uniformity and Furnishings on Panel Heating Performance, by L. F. Schutrum and C. M. Humphreys (ASHVE Journal Section, *Heating, Piping & Air Conditioning*, February 1954, p. 131).

DISCUSSION

R. C. Chewning, Portland, Ore. (Written): ASHVE research and the data provided by that research and reported in this and other papers are of great value to our Society. Several years ago, when the *boom* in panel heating started in this country, many engineers and contractors were faced with the problem of designing or installing their first panel heating system. Data were hard to obtain and largely unreliable. The research data being obtained by the Society are doing much to correct that situation.

Any criticism of the paper can be made only on the approach to obtaining the data as it affects its presentation. Much of the research performed by the Society is not known, used or appreciated. This paper offers an example of one of the reasons for this condition.

Reference is made to Table 1 in the paper. The tests run with a uniform environment show ceiling panel temperatures varying from 110.7 F to 120.3 F, panel outputs varying from 50.0 to 61.5 Btu per sq ft, and room temperatures varying from 62.0 F to 68.9 F at the 60-in. level. Considerable study is required to associate the variables in the various tests so that a knowledge of what the tests indicate may be obtained.

It would seem that curves or graphs properly designed would have illustrated the points being demonstrated much more clearly with less study being required of the reader.

In the tests on the non-uniform environment reported in the same table, the room temperatures are allowed to climb as high as 80 F at the 60-in. level. Much of the value of these data is lost because of the amount of study required to correlate the meanings of the figures. The many variables involved force the reader to accept the authors' conclusion without supporting evidence, unless he (the reader) undertakes a research project on the paper itself. Certainly it would have been possible to have maintained the same room temperature, the same AUST, and the same panel temperature in each test so that the Btu output per square foot could be observed to determine the effect of non-uniform environment. Panel temperature effects could have been demonstrated on a similar basis.

Very probably the method used was the easiest way to obtain the information desired, but the object of the Society is "to advance the arts and sciences of heating, ventilating, cooling and air conditioning, and the allied arts and sciences, *for the benefit of the general public.*" Certainly, unless the knowledge contained in research data is presented in a manner to promote its understanding by the members of the Society there is small chance of that knowledge being used for the *benefit of the public.*

R. J. Mindak, Chicago, Ill.: I would like to offer a constructive suggestion and also to reply to Mr. Chewning. From a quick perusal of this paper it is apparent that there is a wealth of information contained therein — too much perhaps for one paper. In my opinion, the usefulness of the data would have been greatly enhanced if presented in two papers.

Commenting on Mr. Chewning's remarks, I can state that it is physically impossible to maintain all the temperatures constant during a series of tests. One of the three temperatures — panel surface, AUST, or room air — must be the dependent variable. I wonder if the problems involved in conducting these tests are fully appreciated by the previous critic. In collecting data such as these, one must compromise between ideal methods and practicability. This type of research requires considerable time and money and the investigator is faced with the problem of obtaining the best possible data in the shortest possible time at the least possible cost. Based on my own experiences in this same field of study I believe the data are excellent and were obtained in the best and quickest way possible.

R. G. Vanderweil, Boston, Mass.: I believe the data compiled and reported in this paper will ultimately help the practicing engineer because the results presented will facilitate simplified computation methods.

Is it possible now, to take one further step and to find one common solution applicable to any room of normal proportions which will state the number of Btu's delivered per square foot of floor (or ceiling) panel for a given panel surface temperature and a given design temperature? In other words, is the shape of rooms of normal practical proportions of small enough influence so that we can simplify the complicated calculations considering form factors? Such simplification was proposed in several engineering articles which I have written and which were published in 1945 and 1946.

M. L. Ghai, Hartford, Conn. First of all I would like to emphasize the importance of this paper. There are a number of applications involving rooms with high aspect ratios and one wonders if radiant heating could be used for these applications.

I am somewhat surprised at the conclusion of the authors that the room dimensions did not have any appreciable effect. This is probably due to rather low aspect ratios which were tried for experimentation.

In 1950 the writer worked on studies of radiant heating of spaces with large aspect ratios, such as railroad passenger car roomettes. Some of this work was published in the March, 1950 issue of *Railway Mechanical Engineering*. The tests indicated that the aspect ratios had considerable effect on the comfort. With radiant heat in the ceiling, stratification of air temperature was difficult to overcome, especially if the panels are designed for high output. The stratification of air temperature resulting from the non-uniformity of panel temperatures affected the panel performance.

It is also of interest to note the effect on variation of local radiant temperatures in the heated space resulting from non-uniformity of panel temperatures and room dimensions with high aspect ratio. Non-uniform panel temperatures can cause considerable variation of radiant temperatures, especially when accompanied by stratification of air temperatures, and can as a result give widely varying conditions of comfort.

The room sizes that the ASHVE Laboratory experimented with are very well selected for residential heating. I wonder if it is possible to extend some of these tests to rooms of still larger aspect ratios. These would be of interest in radiant heating of railroad cars, buses, ships and probably airplanes.

Another project of research of general interest would be to study the effect of room size and non-uniformity of panel temperatures on the variation in the heated space of temperatures, and the variation of average air and radiant temperature indicating the comfort.

This is an excellent paper. I do not agree with the criticism that the paper does not present material in a manner in which it can be readily used by the application engineer. It often takes some time to understand and fully utilize the data presented in a good research paper of this type, but the importance of the paper should not be underemphasized.

Authors' Closure (L. F. Schutrum): Thank you, Dr. Ghai, for your interesting discussion of some of the problems encountered in panel heating. Studies of human comfort under panel heating and cooling conditions will be made in the Environment Laboratory when the panel cooling tests are completed. This work will be under the guidance of the TAC on Sensations of Comfort. It is not possible to increase the aspect ratio in the Environment Laboratory without installing partitions; however, this may be required in the future for the studies in human comfort.

The data in this paper do indicate that the shape of rooms of practical proportions, such as those found in normal residences, has small influence so that the simplification of otherwise complicated calculations is justified, as Mr. Vanderweil had pointed out a number of years ago.

Mr. Mindak's statement that this paper probably should have been two papers is shared by the authors.

In answer to a question by Mr. Chewning, it is not possible to maintain the same room air temperature, the same average unheated surface temperature, and same panel temperature in each test as suggested, for only two of these variables can be controlled. The panel output and one other variable, whether it is the air temperature, the panel temperature, or the AUST, are dependent variables. In the normal testing procedure, it was convenient to control the surface temperatures; consequently, the room air temperature and panel outputs were found by experimentation.

Mr. Chewning also criticized the manner in which the data are presented. It is not always possible to investigate the importance of the variables involved and maintain at the same time practical values for these variables. Mr. Chewning states that the many variables involved force the reader to accept the author's conclusion without supporting evidence. It is these many variables which make the problem complex and the papers involved. If a more simple method of presentation were known, it would have been used; however, it has always been the intent that sufficient fundamental data be included with each of these papers, so that the reader may draw his own conclusions.

The criticism that Laboratory papers are difficult to understand is not a new one and the Laboratory staff is continuously striving to make papers as interesting and readable as possible; however, this frequently presents a problem. Papers can be published as they are now in a detailed but unfortunately complex manner at the end of each phase of the overall research program, or can be held up until the final answers are known. In the latter method, work may go on for years without publication and consequently, the membership would not be familiar with what is being done. When the final paper is published, it would be limited in size by the requirements of the Society, and would probably give the results without sufficient evidence to support the conclusions.

The study presented in this series of papers has been guided by the Group B Subcommittee of the TAC on Panel Heating and Cooling. A similar series of experiments under the guidance of the Group A Subcommittee has resulted in information on plaster and concrete panels. At the present time, there is a subcommittee of these groups which is in the process of developing a design procedure. They are taking all of the work from these papers which is difficult to understand, and from these, working out a design procedure which we hope will be usable and reasonably correct. When the paper is published, you will have had the substantiating data, and it is hoped that you will find it satisfactory.

ASHVE MEETINGS

Philadelphia — January 1955
Bellevue-Stratford Hotel

•

San Francisco — June 1955
St. Francis Hotel

•

Cincinnati — January 1956
Sheraton Gibson Hotel

Characteristics of Downward Jets of Heated Air From a Vertical Discharge Unit Heater

By Linn Helander*, S. M. Yen, and L. B. Knee†, Manhattan, Kans.**

This paper is the result of research sponsored by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in cooperation with the Engineering Experiment Station of Kansas State College.

THIS PAPER is the third of a series on downwardly projected jets of heated air giving the results of research conducted under the guidance of the ASHVE Technical Advisory Committee on Air Distribution‡. The previous work may be briefly summarized as follows:

The first paper[1] dealt with the results of a preliminary study of jets from two outlets, and presented a tentative equation for estimating the downward throw of jets of the type studied. Using symbols listed in Nomenclature, this equation has the form:

$$L_{max}/D_o = (1/a)\ [(a\ \overline{B}_o + 1)^{\frac{1}{2}} - 1]\ \dots\dots(1)$$

where

$\overline{B}_o$ is denoted as the cross-stream average buoyancy number at the outlet.

The second paper[2] dealt with the down throw of approximately free jets from long-radius *ASME* nozzles attached to the base of a plenum chamber. In this second paper, an extensive amount of data on downward throws greater than approximately 8 orifice diameters and less than 45 orifice diameters were presented. These data were correlated by the empirical equation:

$$L_{max}/D_o = 1.66\ B_o^{\frac{1}{2}}\ \dots\dots(2)$$

SUMMARY — The most effective throw and air distribution from a unit heater are obtained when the fan and outlet are properly designed and properly matched to each other.

This investigation shows the effect of combinations of two types of fans and three types of outlets on downward projected jets from a unit heater.

Down throws of heated air jets in excess of 8 orifice diameters are correlated with previously published data on jets from *ASME* nozzles by means of an equation in which an empirical throw factor f is determined experimentally. The effect of outlet and fan construction features on the factor f are illustrated.

Criteria for evaluating the effectiveness with which jets utilize outlet down thrust and outlet air horsepower to produce throw are defined and are applied to the jets studied.

where

B_o is the buoyancy number evaluated at the center of the outlet.

For the range of conditions for which Equation 2 applies, B_o may be set equal to 1.04 $\overline{B}_o$. Making this substitution:

$$L_{max}/D_o = 1.70\ \overline{B}_o^{\frac{1}{2}}\ \dots\dots(3)$$

Object of Tests

The present paper gives experimentally determined data on the down throws of jets from a vertical discharge unit heater the construction of which conformed to that of units being manufactured and used.

For throws in excess of approximately 8 orifice diameters, these data were correlated with data presented in the second[2] of the two previous papers by means of the following modification of Equation 3:

$$L_{max}/D_o = 1.70\ f\ \overline{B}_o^{\frac{1}{2}}\ \dots\dots(4)$$

Here f is an arbitrarily introduced empirical throw factor determined by test for each of three differently shaped outlets and each of two differently matched unit-heater fans.

Equations 4*a*, 4*b*, 4*c*, and 4*d*, are useful in solving for the various terms in Equation 4.

$$\overline{B}_o = (\overline{U}_o^2/gD_o)/[(\overline{T}_o - T_a)/T_a]\ \dots\dots(4a)$$

$$\overline{U}_o = Q_o/60\ A_o\ \dots\dots(4b)$$

$$L_{max} = 0.30\ f\ \overline{U}_o\ [(D_oT_a)/(\overline{T}_o - T_a)]^{\frac{1}{2}}\ \dots\dots(4c)$$

$$D_o = 0.034\ (f\ Q_o/L_{max})^{\frac{2}{3}}\ [T_a/(\overline{T}_o - T_a)]^{\frac{1}{3}}\ \dots\dots(4d)$$

Three examples in the use of Equations 4 to 4*d* will be given.

Example 1: Given the following data, evaluate $\overline{B}_o$ and f:

L_{max} = throw = 21.8 ft.
Q_o = flow of air at outlet = 1410 cfm.
D_o = diameter of outlet = 1 ft.
A_o = area of outlet = 0.785 sq ft.
$\overline{t}_o$ = average temperature of air at outlet = 200 F.
$\overline{T}_o$ = average absolute temperature of air at outlet = 660 F.
t_a = temperature of room air = 70 F.
T_a = absolute temperature of room air = 530 F.

From Equation 4*b*:

$$\overline{U}_o = 1410/(60 \times 0.785) = 30 \text{ ft per sec.}$$

From Equation 4*a*:

$$\overline{B}_o = [30^2/(32.2 \times 1)]/[(660 - 530)/530] = 114$$

From 4:

$$f = \frac{L_{max}/D_o}{1.70\overline{B}_o^{\frac{1}{2}}} = \frac{21.8/1}{1.70\sqrt{114}} = 1.20$$

---

*Professor and Head, Department of Mechanical Engineering, Kansas State College. Member of ASHVE.

**Assistant Professor, Department of Mechanical Engineering, Kansas State College.

†Instructor, Department of Mechanical Engineering, Kansas State College.

‡Personnel: G. B. Priester, Chairman; W. A. Grant, Vice Chairman; J. M. Black, H. F. Brinen, R. M. Conner, S. H. Downs, Nathan Feder, S. F. Gilman, Linn Helander, F. B. Holgate, W. O. Huebner, W. W. Kennedy, E. J. Kurek, R. D. Madison, G. E. McElroy, L. G. Miller, H. B. Nottage, C. H. Randolph, G. L. Tuve.

[1] Exponent numerals refer to References.

For presentation at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Swampscott, Mass., June 1954.

Example 2: Given the following data, determine diameter of outlet required. Heat to be supplied by unit heater = 158,000 Btu/hr.

Quantity of standard, 70 F air to be supplied by unit = 1130 cfm.

L_{max} = down throw of jet = 21.8 ft.

f = throw factor = 1.20

Mass rate of flow at outlet = 1130 × 0.075 = 84.7 lb/min.

Temperature elevation of outlet air

= (Heat supplied, Btu/hr)/[60 × (outlet air, lb/min) × (specific heat of air)]

= 158,000/[60 × 84.7 × 0.24] = 130 F

$\bar{t}_o$ = average temperature of outlet air = 70 + 130 = 200 F.

$\bar{T}_o$ = average absolute temperature of outlet air = 200 + 460 = 660 F absolute.

T_a = absolute temperature of room air = 70 + 460 = 530 F absolute.

Q_o = volume rate of flow at outlet = $(\bar{T}_o/530) \times 1130 = (660/530) \times 1130 = 1410$ cfm.

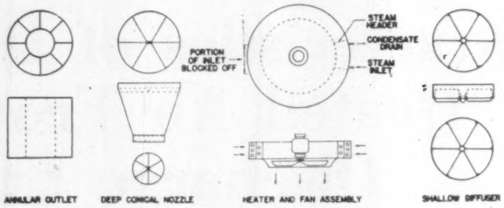


Fig. 1—Schematic drawing of heater and outlet

From Equation 4*d*:

$D_o = 0.034\ (1.20 \times 1410/21.8)^{\frac{2}{3}}\ [530/(660 - 530)]^{\frac{1}{3}} = 1$ ft.

Example 3: Given all of the data under *Example 2* except the down throw, L_{max}, determine L_{max}.

From Equation 4*b*:

$\bar{U}_o = 1410/60 \times 0.785 = 30$ ft per sec.

From equation 4*c*:

$L_{max} = 0.30 \times 1.20 \times 30\ [1 \times 530/(660 - 530)]^{\frac{1}{2}} = 21.8$ ft.

Performance Factors

In order to evaluate the effectiveness with which the jets utilized initial down thrust and outlet air horsepower to produce throw, two

Nomenclature

a = a dimensionless entrainment factor.

A = area, square feet. In Figs. 10, 11, and 12, A is portion of outlet over which corresponding ordinate has been exceeded, square feet.

A_o = area of outlet, square feet.

A_e = effective area of outlet, square feet.

B_o = buoyancy number evaluated at center of outlet, $(U_o^2/gD_o)/[(T_o/T_a)-1]$.

$\bar{B}_o$ = cross-stream average buoyancy number at outlet, $(\bar{U}_o^2/gD_o)/[(\bar{T}_o/T_a)-1]$.

D_o = orifice diameter of outlet, feet.

dA = differential area at outlet, square feet.

f = throw factor, used in Equation 4.

g = gravitational acceleration, 32.2 feet per (second) (second).

g_c = 32.2 [(lb — mass/lb — force)] (ft/sec²)

L_{max} = distance from outlet to bottom (see Glossary) of jet, feet.

M_o = mass rate of flow at outlet, pounds per second.

o = subscript denoting value at outlet.

ΔP = $P - P_a$ = local static pressure at outlet in pounds per square foot, gage.

P = local pressure at outlet, pounds per square foot, absolute.

P_a = atmospheric pressure at level of outlet, pounds per square foot, absolute.

Q_o = volume rate of flow at outlet, cubic feet per minute.

T = local temperature at outlet, Fahrenheit, absolute.

$\bar{T}_o$ = mass-mean temperature at outlet, Fahrenheit, absolute.

T_a = temperature of undisturbed room air, measured at instrument table approximately 30 in. above floor, Fahrenheit, absolute.

U = local velocity at outlet, feet per second.

U_o = value of U at center of outlet.

$\bar{U}_o$ = cross-stream average velocity at outlet = volume rate of flow/area of outlet, feet per second.

U_{om} = maximum local velocity at outlet, feet per second.

a_1 = ratio of average to maximum outlet velocity = $\bar{U}_o/U_{om} = (\int U dA)/(U_{om}A_o)$.

β_2 = relative outlet down thrust =

$$\left[\int \frac{\rho U^2 dA}{g_c} + \int (\Delta P) dA\right] \Big/ \frac{M_o \bar{U}_o}{g_c}$$

β'_2 = relative outlet momentum force =

$$\int \frac{\rho U^2 dA}{M_o \bar{U}_o}$$

β_3^2 = relative outlet air horsepower =

$$\left[\int \frac{\rho U^3 dA}{2g_c} + \int (\Delta P) U dA\right] \Big/ \frac{M_o \bar{U}_o^2}{2g_c}$$

$(\beta'_3)^2$ = relative outlet flux of kinetic energy =

$$\int \frac{\rho U^3 dA}{M_o \bar{U}_o^2}$$

ρ = local mass density at outlet, pounds per cubic foot.

$\bar{\rho}_o$ = mean mass density at outlet, pounds per cubic foot.

θ = angle of spread at the outlet.

Glossary of Terms

Down Thrust =

$$\int \frac{\rho U^2}{g_c} dA + \int (\Delta P) dA$$

Air Horsepower =

$$\left[\int \frac{\rho U^3}{2g_c} dA + \int (\Delta P) U dA\right] \Big/ 550$$

Relative Down Thrust = ratio of actual down thrust to down thrust that a flat velocity profile would develop with the same flow and the same outlet area.

Relative Air Horsepower = ratio of actual air horsepower to the air horsepower that a flat velocity profile would develop with the same flow and the same outlet area.

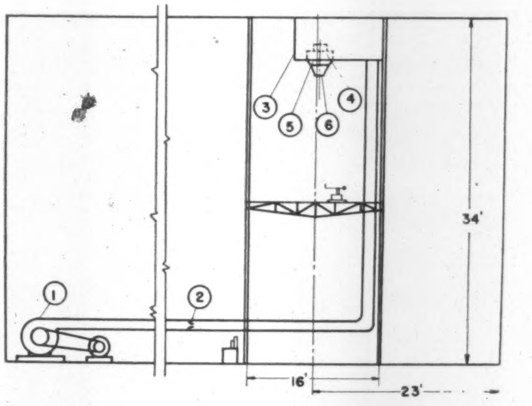
Standard Jet = An idealized jet that: (1) has a flat velocity profile at the outlet, (2) develops a value of f equal to unity, (3) delivers the same amount of outlet air and heat as the actual jet to be compared to it delivers, and (4) produces the same throw in feet as the actual jet produces. For the standard jet, a_1, β_2, and β_3^2 are each equal to unity.

Down-Thrust Ratio = Ratio of outlet down thrust of actual jet to outlet down thrust of standard jet = $\beta_2/f^{4/3}$.

Jet-Efficiency Ratio = Ratio of outlet air horsepower of standard jet to outlet air power of actual jet = $f^{8/3}/\beta_3^2$.

Mass-mean temperature = $\int [(\rho\ U\ T)\ dA/M_o]$ = [Heat Input, Btu/hr/(0.24 × 3600 × M_o)] + T_a

Bottom of jet = Point at which a thermocouple and a Prandtl tube simultaneously moved upward along axis of jet from floor level gives first distinct evidence of entering the jet.



Reference numbers: (1) blower, (2) measuring nozzle, (3) plenum chamber, (4) heater, (5) fan, (6) outlet.

Fig. 2—Schematic arrangement of equipment

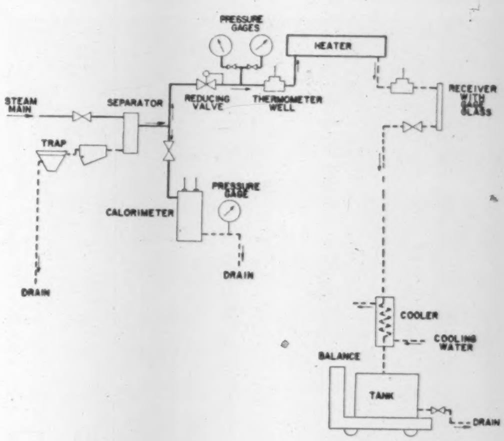


Fig. 3—Schematic arrangement of equipment for measuring heat delivery to jet

performance factors, in addition to *f*, have been introduced. They are:

1. Down-thrust ratio, defined as the ratio of the down thrust of the actual jet to that of a standard jet* (subsequently defined) which produces the same throw in feet as the actual jet produces; and

2. Jet-efficiency ratio, defined as the ratio of the outlet air horsepower of the standard jet to that of the actual jet.

Values of these ratios and of *f*, together with other pertinent data, are given in Table 1, which presents the principal results of the studies completed on a unit heater operated as described in the following section.

Equipment and Procedures Employed

Two series of tests were run. In the first series, a unit-heater fan was employed which subsequently was found to have excessive tip clearances for the outlets employed. In the second series of tests, an appropriate

---

*See Glossary for meaning of terms marked with an asterisk.

Table 1—Test Results for Normal Service Conditions and for Equivalent Flows with Fan Idling

Data	Shallow Diffuser		Deep Conical Nozzle			Annular Outlet	
	Fan No. 1 In Service[a]	Fan No. 1 Idling	Fan No. 1 In Service	Fan No. 2 In Service[a]	Fan No. 1 Idling	Fan No. 2 In Service	Fan No. 2 Idling
Basic							
Orifice diam D_o ft	1.44	1.44	1.14	1.14	1.14	1.44	1.44
Flow at outlet, cfm	894	903	707	1,070	698	1,580	1,620
Heat Delivery, Btu/hr	49,000	53,000	40,400	50,500	45,000	75,000	78,700
Input, to motor, kw	0.159	——	0.164	0.156	——	0.170	——
Static Press. in plenum chamber, in. water	0	0.088	0	0	0.081	0	0.286
Avg Outlet Temp, F	141	143	140	132	140	121	120
Avg Room Temp, F	82	79	78	80	70	71	70
Avg Outlet Vel, fps	9.15	9.24	11.55	17.40	11.40	16.20	16.60
Avg Outlet Vel, fpm	549	554	693	1,040	684	972	996
Throw, L_{max} ft	11.5	10.5	13.5	18.0	10.3	20.0	18.5
Angle of Spread, deg[c]	31	26	18	18	18	20	20
Avg Static Press at Outlet, in. water	−0.022	−0.001	−0.002	+0.001	−0.001	−0.007	−0.004
Dimensionless Outlet							
Buoyancy Number, $\overline{B}_o$	16.6	15.5	31.6	86.1	26.8	60.1	63.3
Fraction of Area Effective, A_e/A_o	0.48	0.91	0.75	0.99	1.00	0.80	0.96
Ratio of Avg Vel to maximum velocity, a_1	0.25	0.67	0.36	0.57	0.93	0.51	0.73
Relative Outlet Downthrust, β_2	1.68	1.14	1.59	1.13	0.98	1.35	1.03
Relative Outlet Momentum force, β'_2	2.36	1.16	1.63	1.12	1.00	1.42	1.07
Relative Outlet Air Horsepower, $\beta_3{}^2$	5.19	1.40	2.95	1.36	0.97	1.90	1.12
Relative Flux of Kinetic Energy, $(\beta'_3)^2$	6.55	1.44	3.03	1.34	1.02	2.03	1.19
Relative Extent of Whirl[b]	4	1	3	2	1	3	1
Relative Irregularity of Vel Distribution[b]	4	1	3	1	0	2	1
Performance							
L_{max}/D_o	8.0	7.2	11.8	15.8	9.1	13.9	12.9
Throw factor, *f*	1.15	1.08	1.24	1.00	1.03	1.05	0.96
Down-thrust Ratio	1.40	1.03	1.20	1.13	0.94	1.26	1.08
Jet-Efficiency Ratio	0.28	0.88	0.60	0.74	1.11	0.60	0.80

[a] Fan No. 1: Original Fan; Fan No. 2: Replacement Fan.

[b] Numbers represent order in which magnitudes fall: 4 represents the largest magnitude observed, 1 the minimum. Zero implies that no whirl or irregularity in the velocity distribution was observed.

[c] Angle of spread of ***unheated*** jets.

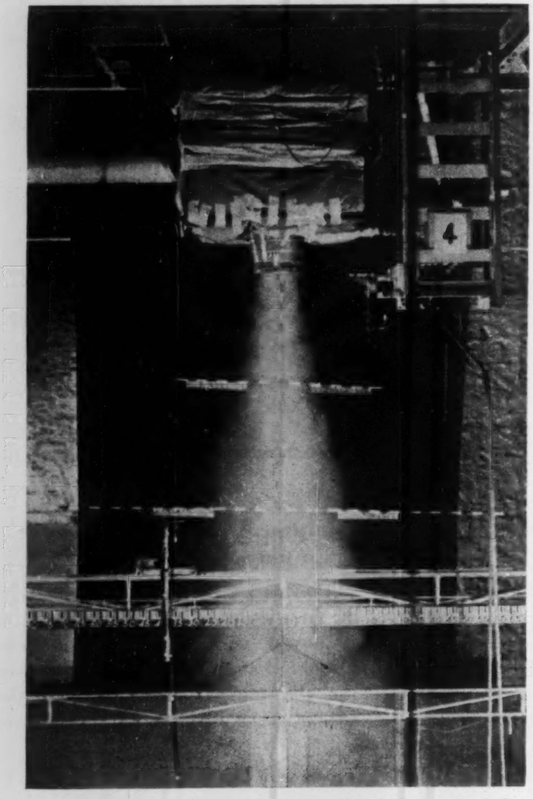


Fig. 4—Jet from deep conical nozzle with original fan at full speed

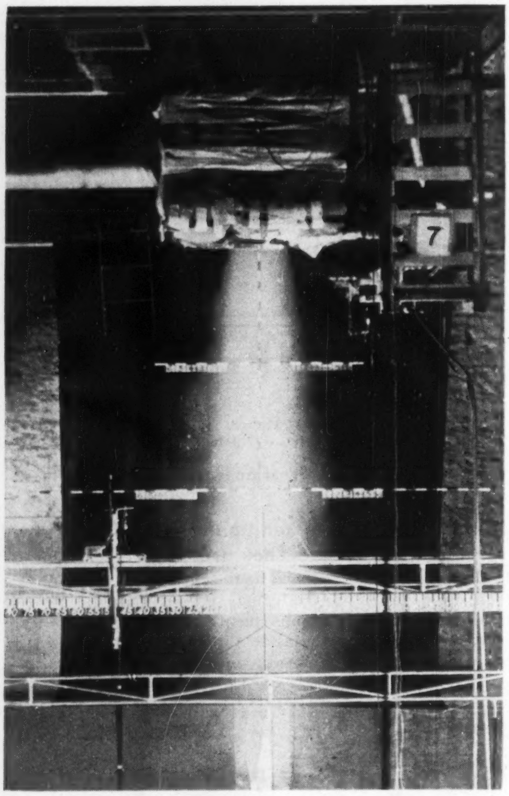


Fig. 5—Jet from shallow diffuser with original fan at full speed

fan was employed. In view of the purpose of the studies conducted, the data from both series of tests are presented.

In the first series of tests, two types of outlets were employed:

1. A deep conical nozzle with fixed guide vanes; and
2. A shallow diffuser with adjustable guide vanes which were set vertical.

In the second series of tests, two types of outlets also were employed:

1. The deep conical nozzle employed in the first series of tests; and
2. An annular outlet formed by two concentric cylinders with intervening vertical guide vanes.

The outlets, the heater, and the set-up of equipment are shown in Figs. 1 and 2.

The techniques mainly used are those described in the previous papers.[1,2] In particular, the bottom of the jet was established by simultaneously moving both a thermocouple and a Prandtl-type impact tube upward into the jet from the floor level and noting the point at which both gave evidence of entering the jet. In the second series of tests, impact-tube and static pressure differentials less than 0.01 in. of water were measured and recorded by means of a newly developed, highly sensitive, electronic, pressure-differential recorder, and this recorder was also used to locate the point of maximum downward travel of the jet. Although independently developed at Kansas State College, this instrumentation is similar in basic design to instrumentation developed by the National Bureau of Standards and described in the Bureau's Report 2165[3]. All temperatures for both series of tests were recorded by means of a sensitive, high-speed, electronic recorder.

The unit heater was placed in a plenum chamber to which a measured flow of unheated air was delivered by means of an external blower. The unit-heater fan was operated at each of three speeds: full speed (1100 *rpm*), three quarters speed (800 *rpm*), and idling, *i.e.*, with the fan power shut off. Under the latter condition, the flow of air through the heater was sustained solely by the external blower. For normal service conditions, atmospheric pressure was maintained in the plenum chamber. In the first series of tests, data on throws beyond the normal range of the heater fan were obtained by employing higher than atmospheric pressure in the plenum chamber.

Air entered the heater radially. In order to obtain an approximately symmetrical jet, it was found necessary to compensate for the segment of the air-inlet area of the heater that was blocked off by the steam header where the header entered the heater. This was accomplished by blocking off a corresponding segment of the air-inlet area directly opposite the header. (See Fig. 1)

Temperatures recorded as outlet temperatures are mass mean temperatures (see Glossary). In the initial sequence of tests, during which the original fan and the deep conical nozzle were employed, the mass-mean outlet temperature was obtained principally by means of a circular grid made up of approximately 50 thermocouples and calibrated in place against heat-balance data. In all subsequent tests, including all of the tests listed in Table 1, the outlet temperature was evaluated directly from heat-balance data. However, the circular grid of thermocouples was continuously employed to check the temperatures at the outlet. The grid measured directly the cross-stream, time-mean temperatures. These agreed with mass-mean temperatures evaluated from heat-balance data only when the outlet-velocity profile was fairly flat.

Fig. 3 shows schematically the arrangement of equipment employed for measuring the rate of heat delivery to the jet. The enthalpy of the steam entering the heater was determined by means of a throttling calorimeter placed ahead of the reducing valve. Condensate from the heater was accumulated over a period of 45 min to 1½ hr and then weighed.

The angle of spread of the heated jet could not be measured satisfactorily due principally to conditions produced at the outlet by both entrainment and the recirculation of heated air from the base of the heated jet. The angles of spread reported for the heated-air jets are, in fact, angles of spread of corresponding isothermal jets. These were approximated visually, using the scale shown in Figs. 4, 5, and 6, and by means of the smoke-gun technique described in the previous paper[2] on jets from *ASME* nozzles. These means are recognized as not being entirely reliable, but they were deemed to provide a qualitative indication of the effect of the heater fan and the outlet on the angle of spread.

Prandtl-tube determinations of velocity and static pressure were recognized as being unreliable under the outlet conditions that prevailed when the heater fan was operated. For this reason, Prandtl-tube determinations of outlet velocities were used only to establish the distribution and relative magnitude of the local velocities at the outlet. Mass rates of flow determined from Prandtl-tube readings at the outlet differed from the measured mass rate of flow to the plenum chamber by an average of 4 percent and a maximum of 7 per-

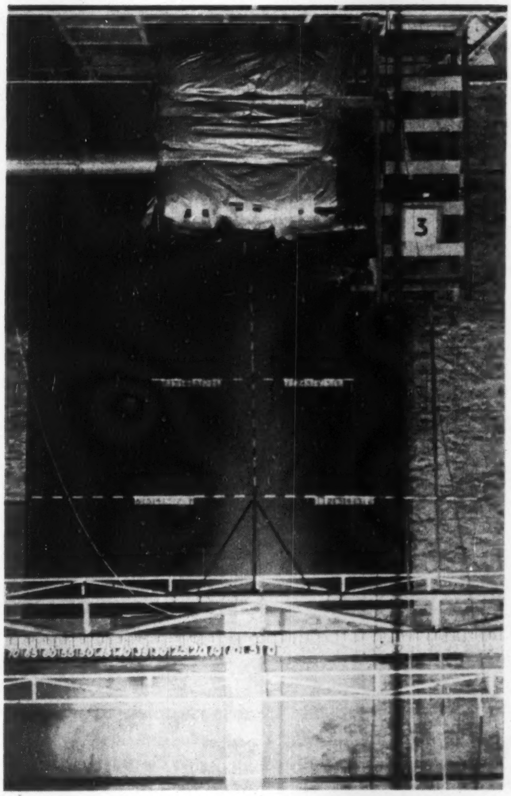


Fig. 6—Jet from annular outlet with replacement fan at full speed

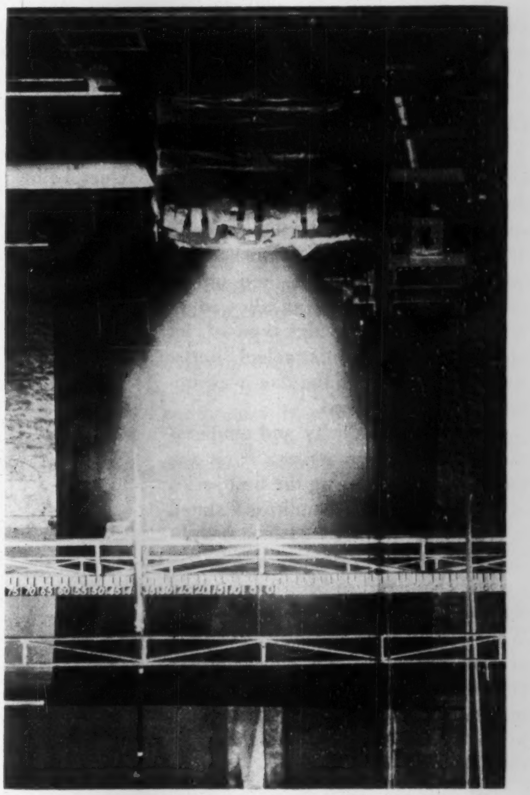


Fig. 7—Jet from heater with no attached outlet with fan at full speed

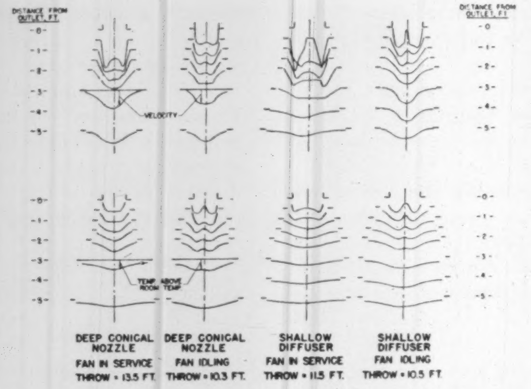


Fig. 8—Velocity and temperature profiles for heater equipped with original fan

cent. In all but one case, that in which the maximum of whirl occurred, static pressure readings were of such a small order of magnitude that they might have been neglected. With one exception, the measured values of static pressure were negative. Correct static pressures may be regarded as being not less than the measured values.

Character of Jets

Figs. 4 to 6 showing the jet made visible by smoke were obtained when the heater fan was operated at full speed. However, no characteristic difference could be distinguished between these photographs and others taken when the fan was allowed to idle. Fig. 7 shows the type of jet obtained when no attached outlet was employed and the fan was operated at full speed.

Fig. 8 shows velocity and temperature profiles down stream from the outlet, obtained during the first series of tests under the conditions stated in Table 1.

Fig. 9 shows corresponding velocity and temperature profiles obtained during the second series of tests. Where profiles of velocities precisely at the outlet are not shown, these velocities were too irregularly distributed over the area of the outlet to be represented by a single cross-diameter profile.

The annular outlet emitted an annular jet with a stagnant core when the heater fan was in service, and a partly active core when this fan was allowed to idle. This accounts largely for the shapes of the velocity profiles obtained in the vicinity of the annular outlet. In the case of the other outlets, distortions of the velocity profiles in the vicinity of the outlet were due to the heater fan, or to the fan motor and fan hub at the central axis of the outlet. In all cases, velocity profiles underwent progressive change downstream from the outlet and assumed an approximately fully developed form several orifice diameters below the outlet.

Outlet Conditions

At the outlet one group of factors having a bearing on throw could be evaluated numerically; the other group could not. The first group included:

1. The apex angle or angle of spread of the issuing jet.
2. The fraction of the gross area of the outlet that was dead area, *i.e.*, area unoccupied by down-flowing air.
3. The force or down thrust of the jet as it left the outlet.
4. The air horsepower of the jet as it left the outlet.

The second group, which was made up of factors which could be evaluated only qualitatively, included:

1. The degree of whirl, turbulence, and reversals of the flow in the issuing jet.
2. The degree of irregularity in the distribution of velocities of different magnitudes over the area of the outlet and the amount of mixing that consequently must have occurred to form a fully developed profile.
3. Conditions external to the jet in the vicinity of the outlet produced by the external shape of the outlet and the manner in which it was suspended.

Angles of spread tabulated in Table 1 are angles of spread measured on unheated jets having the same volume rates of flow as the corresponding heated jets. The angles so measured should have relative significance, but they probably are not identical with the angles of spread actually developed by the heated jets. Angles of spread for all outlets other than the short diffuser were between 18 and 20 deg.

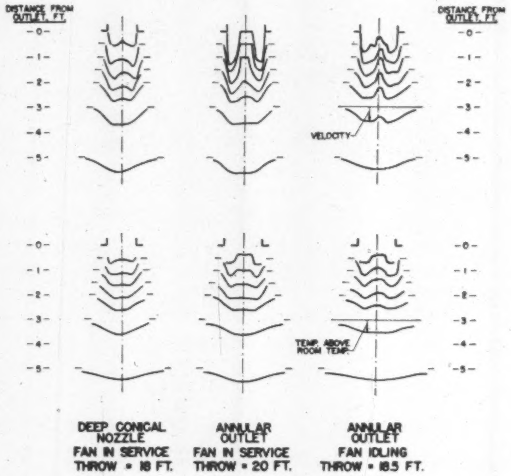


Fig. 9—Velocity and temperature profiles for heater equipped with replacement fan

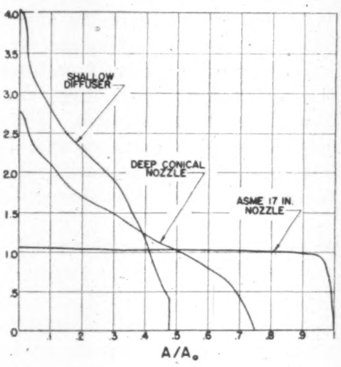


Fig. 10—Area-distributed velocities in sequence of decreasing magnitudes for heater with original fan

The angle of spread for the short diffuser was 26 deg with the heater fan idling, 31 deg with the heater fan in service.

The relative extent of whirl and the degree of irregularity in the distribution of velocity, or flow, at the outlet are indicated in Table 1. Whirl was observed by means of a vertical-bladed pin wheel. For outlets other than the annular outlet, the fraction of dead area at the outlet was felt to be somewhat indicative of the amount of whirl present. Evaluations of the degree of irregularity in the distribution of outlet velocities were based on point to point measurements of velocity at the outlet. No attempt was made to explore conditions external to the jet in the vicinity of the outlet or to evaluate the relative order of turbulence and reversals of flow at the outlet.

To evaluate the down thrust and air horsepower of the jet where it left the outlet, velocities were measured at the centers of 1-in. squares over the accessible area of the orifice which included from 80 to 90 percent of the gross area. These velocities were then plotted in a sequence of decreasing magnitudes on a base of traversed outlet area and replotted to form the curves shown in Figs. 10 to 12. In this procedure, the velocity distribution over the inaccessible area was treated as being the same as that over the accessible area. Curves corresponding to those of Figs. 10 to 12 were constructed, but not reproduced, for (1) the downward flux of mass per unit area, ρU; (2) the downward flux of momentum per unit area, ρU^2 and (3) the downward flux of kinetic energy per unit area, ρU^3.

From these curves and data on static pressure at the outlet, the following three factors were obtained (see Nomenclature for defining equations):

α_1 = Ratio of average outlet velocity, $\bar{U}_o$, to maximum local velocity, U_{om}.

β_2 = Relative down thrust of jet = ratio of down thrust at outlet to down thrust that would have occurred had the outlet velocity been uniformly $\bar{U}_o$ and the static pressure uniformly zero.

β_3^2 = Relative air horsepower at outlet = ratio of air horsepower of issuing jet to air horsepower that would have been available had the outlet velocity been uniformly $\bar{U}_o$ and the static pressure uniformly zero.

β_2 is a measure of the force with which the jet issues from the outlet and therefore an index of the capacity of the jet to force itself down against a resisting buoyancy force; β_3^2 is an index of the demand for effective fan power at the outlet. For free jets from outlets that produce an approximately flat velocity profile, β_2 and β_3^2 will each be close to unity; for free jets from other outlets, β_2 and β_3^2 will normally be greater than unity. Values of α_1, β_2, and β_3^2 are given in Table 1.

Performance Criteria

For throws in excess of approximately 8 orifice diameters, two empirical performance criteria were employed:

1. Down-thrust [illegible]io, $\beta_2/f^{4/3}$, and
2. Jet-efficiency ratio, $f^{8/3}/\beta_3^2$. The derivations of these criteria are given in the Appendix to this paper.

To establish the foregoing criteria, a standard reference jet was defined. This jet was taken as an idealized jet for which α_1, β_2, β_3^2, and f were each equal to unity. In addition, the standard jet was defined as one that would deliver the same amount of air and the same amount of heat as the actual jet delivered and would produce the same throw in feet as the actual jet produced. Then:

down-thrust ratio = ratio of outlet down thrust of actual jet to outlet down thrust of standard jet.

jet-efficiency ratio = ratio of outlet air horsepower of standard jet to outlet air horsepower of actual jet.

The down-thrust ratio is a measure of the relative magnitude of the force with which the actual jet issues from the outlet to produce a given throw in feet. The jet-efficiency ratio is an index of the relative efficiency with which the actual jet utilizes outlet air horsepower to produce throw. Values of the foregoing criteria are given in Table 1.

Test Results

Figs. 13 and 14 show plots of f against volume rate of flow based upon data obtained from the series of tests in which the original, or improperly matched fan was employed. Fig. 13 applies to the heater equipped with the deep conical nozzle. Fig. 14 applies to the heater equipped with the shallow diffuser.

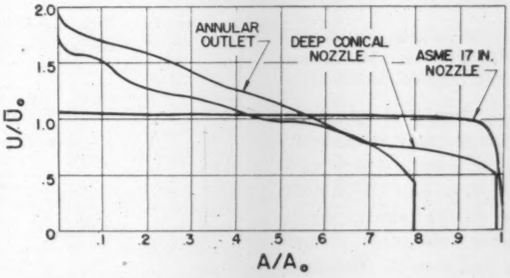


Fig. 11—Area-distributed velocities in sequence of decreasing magnitudes for heater with replacement fan

6

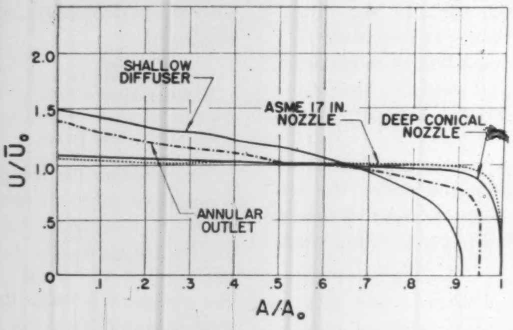


Fig. 12—Area-distributed velocities in sequence of decreasing magnitude for heater with idling fan

To increase the flow beyond the capacity of the fan, a positive static pressure was established in the plenum chamber and progressively increased. Therefore, as the flow increased, the proportion of the flow generated by the fan decreased.

With the fan in service, the static pressure in the plenum chamber was 0 at 600 cfm for the deep conical nozzle, and was increasingly positive for flows progressively greater than 600 cfm and negative for flows less than 600 cfm.

With the fan in service, the static pressure in the plenum chamber was 0 at 760 cfm for the shallow diffuser, and was increasingly positive for flows progressively greater than 760 cfm.

Positive static pressures were maintained in the plenum chamber when the fan was idling with either the conical nozzle or the shallow diffuser. Throws less than 8 orifice diameters are indicated.

The curves in Figs. 13 and 14 show that:

1. The value of f for the conical outlet decreased in magnitude and approached unity as the volume rate of flow increased; and
2. The values of f for the shallow diffuser were lower in magnitude but similar in trend to those of the conical outlet.

In respect to the first of these effects, the inference may reasonably be drawn that the decrease of f with an increase of flow was associated with a decrease in the relative down thrust, β_2. This inference is supported by data in Table 1. The data in this table show that when the flow was generated solely by the fan, β_2 had a value substantially in excess of unity; when the flow was generated solely by an elevation of plenum-chamber pressure, β_2 had a value that approximated unity. In respect to the second of the two effects the inference may be drawn that the lower values of f developed by the shallow diffuser were associated with the substantially larger angle of spread, θ, developed by this outlet.

Table 1 gives data obtained under normal service conditions, *i.e.*, with atmospheric pressure in the plenum chamber, and comparable data obtained with the heater fan idling and a positive static pressure in the plenum chamber. Values of β_2 and $\beta_3{}^2$, uncorrected for static pressure at the outlet, are tabulated in Table 1 as β'_2 and $(\beta'_3)^2$, along with properly evaluated values of β_2 and $\beta_3{}^2$. These uncorrected values are respectively the relative momentum force at the outlet and the relative flux of kinetic energy at the outlet. The difference between the corrected and uncorrected values is significant only for the case wherein the shallow diffuser was employed with the fan in service. In this case, the correction employed was probably excessive, since flow conditions at the outlet were conducive to an inaccurately large static pressure reading in a negative direction.

Previous studies on jets from *ASME* nozzles, indicated that deviations in f of ± 10 percent should be expected under apparently equivalent conditions. It follows that only two values of f deviated significantly from unity. These values were obtained with the original fan in service and were associated with high values of β_2 and $\beta_3{}^2$.

The conical outlet, equipped with the replacement fan, produced a flow 50 percent greater and a throw in feet 33 percent greater than the flow and throw produced by the same outlet equipped with the original fan. The annular outlet in turn delivered a flow 50 percent greater than the conical outlet delivered, and produced a throw in feet 10 percent greater than the latter produced. The maximum power demand of the fan

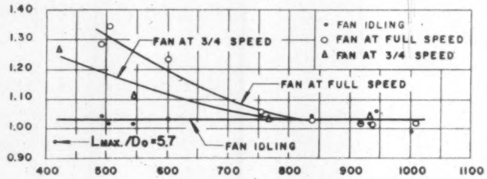


Fig. 13—Values of f developed by the deep conical nozzle equipped with original fan

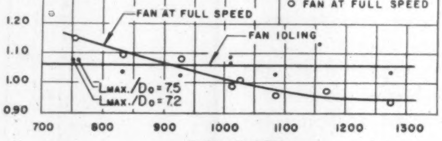


Fig. 14—Values of f developed by the shallow diffuser equipped with the original fan

motor was 0.170 kw, the minimum demand 0.156 kw, a difference of less than 10 percent.

In Table 2, significant data from Table 1 are retabulated to show the effects of converting the fan from idling to service operation.

Table 2—Effect of Fan in Service vs. Fan Idling

Term	Fan	Shallow Diffuser	Deep Conical Nozzle	Annular Outlet	Average
Throw Factor	No. 1 in Service[a]	1.15	1.24	—	1.20
	No. 2 in Service[a]	—	1.00	1.05	1.03
	Idling	1.08	1.03	0.96	1.02
Relative Outlet Down Thrust β_2	No. 1 in Service	1.68	1.59	—	1.64
	No. 2 in Service	—	1.13	1.35	1.24
	Idling	1.14	0.98	1.03	1.05
Relative Outlet Air hp β_3^2	No. 1 in Service	5.19	2.95	—	4.07
	No. 2 in Service	—	1.36	1.90	1.63
	Idling	1.40	0.97	1.12	1.16
Down Thrust Ratio	No. 1 in Service	1.40	1.20	—	1.30
	No. 2 in Service	—	1.13	1.26	1.20
	Idling	1.03	0.94	1.08	1.02
Jet Efficiency Ratio	No. 1 in Service	0.28	0.60	—	0.44
	No. 2 in Service	—	0.74	0.60	0.67
	Idling	0.88	1.11	0.80	0.93

[a] Fan No. 1—Original Fan
Fan No. 2—Replacement Fan

Conclusions

1. The performance of a unit heater will depend upon constructional, operational, and installation features. Performance data presented, therefore, should not be used indiscriminately, nor should they be used as being typical of either unit heaters in general or of the particular unit heater tested.

2. The separate effects of basic outlet factors, β_2, β_3^2, θ etc., on the throw factor (f) could not be evaluated quantitatively. To accomplish this, a fundamental type of research must be pursued.

3. Although the separate effects of basic outlet factors could not be evaluated quantitatively, the data indicate that:

a. An increase in the relative down thrust, β_2, and consequently an increase in the relative outlet air horsepower, β_3^2, promotes an increase in f.

b. A decrease in the effective area of the outlet and an increase in whirl each promotes an increase in the demand for down thrust and air power required at the outlet to maintain a fixed throw in feet. Thus the annular outlet, with 80 percent of the outlet area effective, developed a down-thrust ratio 12 percent greater than that developed by the conical outlet, with 99 percent of its outlet area effective, and a jet-efficiency ratio 19 percent less than the latter developed. The shallow diffuser, with 48 percent of its area effective and the highest level of whirl, developed the highest down-thrust ratio and the lowest jet-efficiency ratio, therefore the highest relative demand for outlet down-thrust and air horsepower.

4. The fan had a pronounced effect on outlet conditions and on the performance of the jet based upon outlet conditions. Thus:

a. The average jet-efficiency ratio was 0.44 with the original fan in service, 0.67 with the replacement fan in service, and 0.93 with the heater fan idling. Corresponding values of the down-thrust ratio were 1.30, 1.20, and 1.02;

b. When the improperly matched (original) fan was replaced by a properly matched fan, the jet-efficiency ratio for the conical outlet was increased from 0.60 to 0.74, the down-thrust ratio was reduced from 1.20 to 1.13, the effective fraction of the outlet area was increased from 0.75 to 0.99, and the factor, f, was reduced from 1.24 to unity.

5. The most advantageous performance based on outlet conditions was provided, for normal service conditions, by the conical outlet equipped with the replacement fan: down-thrust ratio 1.13, jet-efficiency ratio, 0.74. The least advantageous performance for normal service conditions was provided by the shallow diffuser equipped with the original fan: down-thrust ratio 1.40, jet-efficiency ratio 0.28.

6. The shallow diffuser developed the largest angle of spread, an average value of 28 deg for unheated air. The conical and annular outlets developed angles of spread about the same as those characteristic of unheated jets from an *ASME* nozzle.

7. The overall performance of the annular outlet equipped with the replacement fan was superior to that of the other outlets. This outlet delivered 50 percent more air and produced 10 percent more throw in feet than the conical outlet likewise equipped with the replacement fan. The superior performance of the annular outlet must have been due to lowered frictional losses, since the conical outlet was actually superior to the annular outlet in its use of outlet down-thrust and outlet air horsepower.

8. From the foregoing, the following supplementary conclusions may be drawn:

a. The unit heater fan should be carefully matched to the outlet;

b. The outlet and fan combination should be designed for overall effectiveness, that is with regard for both the resistance offered by the outlet to flow and the pattern of flow developed at the outlet. (The external shape of the outlet is also a factor to be considered).

c. The less the whirl, dead area, and irregularity in the distribution of flow at the outlet, the more effective will be the jet's utilization of outlet down-thrust and outlet air horsepower.

d. The throw of a jet may be increased by increasing the velocity of the jet at the outlet and thereby increasing the outlet down thrust and outlet air horsepower. This may be done, for example, by artificially reducing the effective area of the outlet. Whirl, because of its effect on the effective area, may produce the same result.

e. Increasing f in the foregoing manner may entail an increase in power consumption out of proportion to the effect produced on throw. The factor, f, by itself, is therefore not a sufficient criterion of performance. In addition two criteria, the down-thrust ratio and the jet-efficiency ratio, as employed herein, are needed to evaluate the relative effectiveness with which outlet down thrust and outlet air horsepower are utilized.

Recommendations

1. An idealized jet, which may be approximated in the form of a free jet from an *ASME* nozzle installed in accordance with *ASME* code specifications[4] is recommended as a standard jet with which practical jets may be compared in terms of performance. For evaluating the outlet down-thrust ratio and the outlet jet-efficiency ratio, this jet would deliver the same amount of air and heat in unit time as the practical jet delivers, and would produce the same throw in feet as the practical jet produces. For throws in excess of 8 orifice diameters, the standard jet would have a flat velocity profile and values of β_2, β_3^2, and f each equal to unity.

2. Fundamental research, planned to obtain data applicable to the design and operation of practical outlets should be continued, making use of the guidance produced by the research reported herein. Basic objectives of such research should be to determine, separately, the effects of:

a. Reducing the effective area of an outlet.

b. Modifying the velocity profile.

c. Enlarging the angle of spread.

d. Artificially introducing whirl.

e. Modifying the shape and suspension of the outlet.

References

1. ASHVE Research Report No. 1327 — Downward Projection of Heated Air, by Linn Helander and C. V. Jakowatz (ASHVE Transactions, Vol. 54, 1948, p. 71).

2. ASHVE Research Report — Maximum Downward Travel of Heated Jets from Standard Long Radius *ASME* Nozzles, by Linn Helander, S. M. Yen, and R. E. Crank (ASHVE Journal Section, *Heating, Piping & Air Conditioning*, March 1953, p. 123).

3. A Diaphragm-Type, Capacitance-Type, Micromanometer for Very Low Differential Pressures, by T. A. Perls, W. H. Kaechele, and D. S. Goalwin (*National Bureau of Standards Technical Report* 2165).

4. *ASME* Power Test Code Supplement on Instruments and Apparatus, Part 5, Chapter 4, Flow Measurements (*PTC* 19.5-4-1949).

APPENDIX

Evaluations of Down-Thrust Ratio and Jet-Efficiency Ratio, When Throw Exceeds 8 Orifice Diameters

The down thrust of a jet is defined as the total force of the jet as it issues from the outlet. It is made up of the sum of a downward momentum force, $\int (\rho U^2 dA/g_c)$, and a downward force due to static pressure, $\int \Delta P\, dA$.

The air horsepower of the jet is defined as the sum of the downward flux of kinetic energy at the outlet and the power of the jet due to static pressure at the outlet, both expressed in terms of horsepower. Thus:

Air horsepower $= [\int (\rho U^3 dA/2 g_c) + \int (\Delta P U dA)]/550$

Making use of the definitions of β_2 and β_3^2:

Down-thrust of jet $= \beta_2(M_o\bar{U}_o)/g_c$, and .... (A-1)

Air horsepower of jet $= \beta_3^2\ [M_o\bar{U}_o^2/(2g_c)]/550$ .... (A-2)

Let values for the standard jet be indicated by subscript *s*. Then:

Down thrust of standard jet $= \beta_{2s}\ [(M_o\bar{U}_{os})/(g_c)]$ .... (A-3)

Air horsepower of standard jet =

$$(\beta_{3s})^2\left(\frac{M_o(\bar{U}_{os})^2}{2g_c}\right)\Big/550 \text{ ---------------- (A-4)}$$

From Equations A-1, A-2, A-3 and A-4 and definitions of down-thrust and jet-efficiency ratios:*

Down-thrust ratio =

$$\frac{\beta_2(M_o\bar{U}_o/g_c)}{\beta_{2s}(M_o\bar{U}_{os}/g_c)}=\frac{\beta_2\bar{U}_o}{\beta_{2s}\bar{U}_{os}} \text{ ---------- (A-5)}$$

Jet-efficiency ratio =

$$\frac{(\beta_{3s})^2[M_o(\bar{U}_{os})^2/2g_c]}{\beta_3^2[M_o(\bar{U}_o^2)/2g_c]}=\left[\frac{\beta_{3s}\bar{U}_{os}}{\beta_3\bar{U}_o}\right]^2 \text{ ------- (A-6)}$$

From Equation 4 of the paper

$$\frac{L_{max}}{D_o}=1.70 f\bar{B}_o^{\frac{1}{2}}=1.70 f\left[\frac{\bar{U}_o^2/gD_o}{\left(\frac{\bar{T}_o}{T_a}-1\right)}\right]^{\frac{1}{2}}$$

and

$$L_{max}=0.30 f\bar{U}_o\left[\frac{D_o}{\left(\frac{\bar{T}_o-T_a}{T_a}\right)}\right]^{\frac{1}{2}} \text{ --------- (A-7)}$$

For the standard jet, recognizing that L_{max}, $(\bar{T}_o - T_a)$, and T_a are the same for both jets,

$$L_{max}=0.30\bar{U}_{os}f_s\left[\frac{D_{os}}{\left(\frac{\bar{T}_o-T_a}{T_a}\right)}\right]^{\frac{1}{2}} \text{ --------- (A-8)}$$

From Equations A-7 and A-8

$$\bar{U}_{os}=\frac{f}{f_s}\bar{U}_o\left(\frac{D_o}{D_{os}}\right)^{\frac{1}{2}} \text{ ------------------ (A-9)}$$

M_o = Mass rate of flow $= \bar{U}_o\ \bar{\rho}_o\ (\pi D_o^2/4)$

$= \bar{U}_{os}\ \bar{\rho}_{os}\ [\pi\ (D_{os})^2/4]$ .... (A-10)

From Equation A-10, since $\bar{\rho}_o = \bar{\rho}_{os}$;

$(D_o/D_{os}) = (\bar{U}_{os}/\bar{U}_o)^{\frac{1}{2}}$ .... (A-11)

From Equations A-9 and A-10

$\bar{U}_{os} = (f/f_s)^{4/3}\ \bar{U}_o$ .... (A-12)

From Equations A-5 and A-12:

Down-thrust ratio $= (\beta_2/\beta_{2s})\ (f_s/f)^{4/3}$ .... (A-13)

From A-6 and A-12

Jet-efficiency ratio $= (f/f_s)^{8/3}\ (\beta_{3s}/\beta_3)^2$ .... (A-14)

For standard jets with throws in excess of 8 orifice diameters, β_{2s}, β_{3s}^2, and f_s will be unity. Therefore, for throws in excess of 8 orifice diameters:

Down-thrust ratio $= \beta_2/f^{4/3}$ .... (A-15)

Jet-efficiency ratio $= f^{8/3}/\beta_3^2$ .... (A-16)

Significant characteristics of a standard jet and actual jet may be compared as follows:

From Equations A-11 and A-12, by making f_s equal to unity:

$D_{os}/D_o = 1/f^{\frac{2}{3}}$ .... (A-17)

$(L_{max}/D_{os})/(L_{max}/D_o) = D_o/D_{os} = f^{\frac{2}{3}}$ .... (A-18)

$$\frac{\bar{B}_{os}}{\bar{B}_o}=\frac{(\bar{U}_{os})^2/D_{os}}{\bar{U}_o^2/D_o}=\left(\frac{\bar{U}_{os}}{\bar{U}_o}\right)^{\frac{5}{2}}=f^{\frac{10}{3}} \text{ ---- (A-19)}$$

A comparison between an actual jet and standard jet may be made as follows:

Let the following data apply to an actual jet:

$f = 1.20$; $\bar{U}_o = 30$ ft/sec; $D_o = 1$ ft; $\bar{T}_o = (200 + 460) = 660$ F absolute

$T_a = (70 + 460) = 530$ F absolute; $\beta_2 = 1.30$; and $\beta_3^2 = 1.80$. Then:

(*A*) Computations for actual jet.

$$\bar{B}_o=\frac{\bar{U}_o^2/(g\times D_o)}{\left(\frac{\bar{T}_o}{T_a}-1\right)}=\frac{(30)^2/(32.2\times 1)}{\left(\frac{660}{530}-1\right)}=114$$

$L_{max}/D_o = 1.70\ f\ \bar{B}_o^{\frac{1}{2}} = 1.70 \times 1.20\ (114)^{\frac{1}{2}} = 21.8$

$L_{max} = 21.8 \times 1 = 21.8$ ft

$\bar{\rho}_o = 14.7 \times 144/[53.3 \times (200 + 460)] = 0.060$ lb/cu ft

$M_o = \bar{\rho}_o\ \bar{U}_o\ \pi\ D_o^2/4 = 0.060 \times 30 \times \pi \times 1/4 = 1.41$ lb/sec

Down thrust $= \beta_2(M_o\bar{U}_o)/g_c = 1.30 \times 1.41 \times 30/32.2 = 1.71$ lb

Air horsepower $= \beta_3^2\ (M_o\bar{U}_o^2/2\ g_c)/550 = 1.80 \times 1.41 \times (30)^2/(64.4 \times 550) = 0.0645$ hp

(*B*) Computations for the standard jet:

f_s, β_{2s}, and β_{3s}^2 will each be unity

$\bar{U}_{os} = f^{4/3} \times \bar{U}_o = (1.20)^{4/3} \times 30 = 38.3$ ft/sec

$D_{os} = D_o/f^{\frac{2}{3}} = 1/1.20^{\frac{2}{3}} = 0.885$ ft

$\bar{B}_{os} = \bar{B}_o\ f^{10/3} = 114 \times 1.20^{10/3} = 209$

$L_{max}/D_{os} = L_{max}/D_o \times f^{\frac{2}{3}} = 21.8 \times (1.20)^{\frac{2}{3}} = 24.6$

$L_{max} = 24.6 \times D_{os} = 24.6 \times 0.885 = 21.8$ ft

Down-thrust $= \beta_{2s}\ M_o\bar{U}_{os}/g_c = 1 \times 1.41 \times 38.3/32.2 = 1.68$ lb

Air horsepower $= [(\beta_{3s})^2\ M_o\ (\bar{U}_{os})^2/2g_c]/550$
$= 1 \times 1.41 \times (38.3)^2/64.4 \times 550 = 0.0584$ hp.

(*C*) For comparison of actual and standard jets:

Down-thrust ratio $= \beta_2/f^{4/3} = 1.02$

Jet-efficiency ratio $= f^{8/3}/\beta_3^2 = 0.90$

These ratios may also be obtained from preceding computations for actual and standard jets:

Down-thrust ratio $= 1.71/1.68 = 1.02$

Jet-efficiency ratio $= 0.0584/0.0645 = 0.90$

---

*For definitions see Glossary.

DISCUSSION

W. O. Huebner, New York, N. Y. (Written): Vertical discharge unit heaters are used in thousands of industrial plants throughout the country, but we do not know enough about their performance to prevent occasional unsatisfactory application. It is, therefore, necessary to learn more about the basic problems involved, and Professor Helander's investigation serves this end.

This paper is the first to deal quantitatively with the behavior of jets from vertical unit heaters, and it is, therefore, of great practical value. To properly evaluate the paper, it is interesting to compare this with a paper on unit heating presented before the Society 25 years ago. This earlier paper, which discussed the problem entirely in terms of smoke photographs and trained arrows, gave no quantitative information at all, but it was considered a good paper at the time.

We need more exact information today. Professor Helander's throw factor, as well as the down-thrust ratio and the jet-efficiency ratio are useful in dealing with the complex matter of unit heater air distribution.

We should realize that studies of this kind call for time and perseverance, in addition to the necessary scientific qualifications of the investigators. We are fortunate in having the fine cooperation of various institutions to do this kind of research. It is gratifying to know that Professor Helander's air distribution research on unit heaters will be continued. Has the shallow diffuser been used in the test runs with fan No. 2?

G. L. Tuve, Cleveland, Ohio: In this paper Fig. 1 is a schematic drawing showing a number of straightening vanes. Is this an important device that should be a part of the unit heater installation? How did the authors learn that they were necessary?

I. S. Dane, Boston, Mass.: This paper very well describes the downward jet, but as unit heaters have to recirculate air from the floor back up to the unit, I would like to know the characteristics of the action of the air rising to the unit.

W. A. Grant, Syracuse, N. Y.: I would like to compliment the authors on an extremely fine paper. For the same type of outlet, would the authors expect a blowthrough unit heater to give better performance than a drawthrough unit heater in terms of throw and air horsepower efficiency? I would certainly expect, qualitatively at least, that the blowthrough unit would have a better velocity distribution. The heat transfer performance of a blowthrough on the first row is generally better because of all the turbulence; therefore the overall performance might be improved. I would expect the air horsepower performance to be somewhat better.

W. M. Myler, Jr., Columbus, Ohio: This paper deals with the type of unit heater which is almost universally restricted to steam heating. Is there any contemplation of doing any work with gas-fired unit heaters? They usually employ horizontal discharge and have deflecting vanes to direct the heated air stream to the useful area.

L. R. Phillips, Hartford, Conn.: I wonder how much influence the swirl component from the fan had on the downthrow? Have the authors tried different fans or made any notation on the actual discharge pattern of the fan without the diffuser, making note of velocities and swirl components?

R. C. Edwards, Pompton Plains, N. J.: If you are interested in fundamental studies, would it be desirable to take the area normally served by the unit heater and determine the horsepower required to obtain a deviation in the temperature there? A minimum deviation in room air temperature is an important consideration. To simply blow the air down from a unit heater and have it return to the ceiling again is not a good practice. The total horsepower required to run the heater may be less but discomfort of the heated area results.

If the room were half the size described, and the specifications required that the temperature did not deviate from one side of the room to the other more than 2 deg, what is the minimum horsepower to obtain this minimum deviation?

H. H. Yousoufian, New York, N. Y.: The authors have presented an excellent paper in which they indicate the throw obtainable from various forms of basic nozzles discharging heated air downward. The designer of a unit heater or a projection heating system is also interested in knowing how the throw from the various nozzles influences the temperature equalization within the zone of occupancy. In other words, a nozzle which is otherwise efficient in producing a long throw may or may not produce good temperature equalization within the zone of occupancy and is therefore an important consideration in the selection of a nozzle type. I would be interested in knowing what observations, if any, the authors may have made in these respects.

H. E. Ziel, Detroit, Mich.: Could the formulae be used to determine conditions near the floor line if cooler than surrounding air is supplied through the jet to obtain cooling near the floor line? For example, if a blower fan unit were located in a roof truss space 40 ft above the floor line, the truss space temperature was 105 F and the fan unit would draw air in at 95 F from above the roof, what cooling effect could be expected at the floor line? Would not the whirl be desirable?

What should be done with jets to produce as near as possible a cooling effect on men working at the floorline? Might this be compared with the ability to get heat down to the floorline in the wintertime?

Edward Berly,* Waltham, Mass.: At the mouth of the orifice does the author favor a flat velocity distribution or a peaked velocity?

Authors' Closure: Some of the questions raised can be answered only conditionally, if at all. However, the questions raised emphasize the need of the research we are doing and will be helpful in determining the direction of future research.

We are particularly pleased to know that the results of our research will be useful to industry and that Mr. Huebner regards with favor the three performance factors we have defined and employed in our paper, namely, the throw factor, the down-thrust ratio, and the jet-efficiency ratio.

Mr. Heubner has asked whether or not the shallow diffuser was used with Fan No. 2. It was not so used. The time available after we received Fan No. 2 did not permit us to employ the shallow diffuser with this fan.

Mr. Grant suggests certain advantages that a blow-through type of unit heater may have over a draw-through type. We have not tested the blow-through type and so we cannot say that the overall performance of the one would be better than the other. We would expect that the outlet velocity profile would be more favorable in the case of the blow-through type because the heater would serve the same purpose as straightening vanes.

Mr. Yousoufian points out that a nozzle designed to produce a long throw may not provide good temperature equalization in the zone of occupancy. In a given case, the throw for which an outlet will be designed will be determined by the elevation of the outlet above the zone of occupancy. An outlet designed to produce this required throw with a minimum of outlet air horsepower may not provide a satisfactory distribution of air over the zone of occupancy or a satisfactory equalization of temperature. At least two factors other than the efficient use of energy to produce throw are involved here. (1) the spread of the jet and (2) the mixing or entrainment capacity of the jet. If either or both are increased, the outlet air horsepower requirements will probably be increased. There is obviously need for investigation, not yet undertaken, of both the manner in which a jet distributes temperature and velocity in the zone of occupancy and the factors that may be controlled to improve this distribution. Terminal temperatures of the jets that we studied were within a few degrees of room temperature, but we did not employ the jets to heat the room into which they were projected.

---

*Research Division, Raytheon Mfg. Co.

Mr. Edward's question presumably implies that more power may be required to maintain uniformity of temperature in the zone of occupancy than is required solely for the purpose of blowing the air down to a certain level, *e.g.*, close to floor level. Possibly this is so, but we have no data on this. Certainly the problem of effecting a satisfactory distribution of temperature with a minimum of power demand is one deserving of study.

Mr. Dane would like to know the action of the air rising to the unit. Knowledge of this action is essential to a complete understanding of the jet and the influences of the jet on the zone of occupancy. We plan to explore the space outside the jet, and will determine the pattern of upward flow. All we can say at present is that there exists a current of upward air that probably affects the behavior of the jet in a significant manner.

Professor Tuve's question concerns the value of the straightening vanes employed in the outlets tested. These vanes came with the outlets and were vertical. We did not put them in and did not determine their value.

Mr. Phillips asks what influence the whirl component at the outlet may have on the down throw. The effect of whirl on throw is somewhat complicated, because whirl may produce dead area at the outlet, *i.e.*, it may reduce the effective area of the outlet. If it does so, the net result may be an augmentation of the downward momentum flux sufficient to develop a throw greater than would be realized with the same volume rate of flow in the absence of whirl, but the cost in terms of energy consumption will be excessive. Although the effect of whirl cannot be evaluated as an independent factor from our test data, the following data taken from Table 1 are noteworthy:

Magnitude of whirl on scale of 0-4	4	3	2	1
Throw factor f	1.15	1.15	1.00	1.02
Jet-efficiency ratio	0.28	0.60	0.74	0.90
Number of items averaged	1	2	1	3

A low jet-efficiency ratio means a relatively high energy consumption and vice-versa. It would seem that whirl should be avoided so far as practicable.

Mr. Berly's question is whether a flat velocity profile or a peaked velocity profile is preferred? This is a matter we plan to investigate experimentally.

Data from Table 1 for the fan idling are indicative, and are presented here.

Type of Outlet	*Annular*	*Conical*
$\frac{\text{Average Velocity}}{\text{Maximum Local Velocity}}$:	0.73	0.93
Jet-Efficiency Ratio	0.80	1.11

The velocity profile of the conical outlet, as indicated by the ratio of the average velocity to the maximum velocity, was close to being flat; that of the annular outlet deviated significantly from flatness. Other factors than the shape of the velocity profile are involved, and one may question the accuracy of the jet-efficiency ratio of the conical outlet, but the data appear to give preference to a flat velocity profile where economy in the utilization of outlet air horsepower for throw is a primary consideration. A pattern of flow at the outlet that minimizes whirl, eddies, voids, and sharp discontinuities in the velocity profile will probably be a good pattern, regardless of whether the profile is flat or curved. A flat velocity profile will deliver a given rate of flow of air from an outlet of given diameter with a minimum demand for outlet air horsepower. A curved velocity profile will probably develop a larger throw for the same flow, outlet diameter, and heat delivery, but in doing so, it will augment the demand for outlet air horsepower. The same result may be accomplished by means of a core that blocks off the central part of the outlet, but for the best utilization of outlet air horsepower, this core should be shaped to minimize voids and eddies.

We are planning to study chilled jets projected vertically downward, but so far we have studied only heated and isothermal jets. Until experimental data are available on chilled jets, we suggest that Mr. Ziel employ formulas presented in Professor Koestel's paper*, for determining the approximate floor-level temperature of downward jets of chilled air. We do not see how whirl created at the outlet would be helpful at the floor. The whirl so created disappears a short distance from the outlet.

We are not now planning research of the kind referred to by Mr. Myler, *i.e.*, research on horizontal-discharge, gas-fired unit heaters. Perhaps, after we have completed our studies of vertical jets, some work could be done on horizontal jets of the gas-fired type.

The discussions have clearly indicated that what is needed is a means of predicting the performance of a jet in terms of the service it renders, *i.e.*, in terms of the economy and effectiveness with which it distributes temperature and ventilating air over the space to be served. With the continuance of the fine support and encouragement we are receiving from the Society and the *Industrial Unit Heater Association*, we shall continue our studies with this requirement in mind.

---

*Computing Temperatures and Velocities of Vertical Jets of Hot or Cold Air, by Alfred Koestel (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, June 1954, p. 143).

ASHVE-*ASRE* PRESIDENTS ANNOUNCE COOPERATING COMMITTEE

A ten-member Joint Committee on Cooperation has just been announced by Pres. L. N. Hunter of ASHVE and Pres. A. J. Hess of *ASRE* for the purpose of surveying the respective fields of interest, operations, the activities, and services of the two societies. They will propose ways and means of future cooperation in areas of mutual interest.

The Committee personnel is as follows: Representing ASHVE — M. F. Blankin, Philadelphia; P. B. Gordon, New York; J. E. Haines, Minneapolis; E. N. McDonnell, Chicago; and E. R. Queer, State College, Pa. Those representing *ASRE* are: F. H. Faust, Bloomfield, N. J.; C. F. Kayan, James Larkin, J. F. Stone and N. N. Wolpert, all of New York.

The following officers were elected at the organization meeting of the Committee in the Engineers Club in New York: F. H. Faust (*ASRE*) *Chairman;* E. N. McDonnell (ASHVE) *Vice Chairman;* M. C. Turpin (*ASRE*) *Secretary.*

At this meeting the chairman outlined the Committee's objectives, which was followed by a thorough discussion of the functions of the two societies including overlapping membership, scope and methods of operation, publications, research and other activities.

To divide the work of making a survey, the following five subcommittees were appointed: Research and Technical Services (including Codes and Standards) P. B. Gordon and J. F. Stone; Publications, Guide, Data Book and Periodicals, E. N. McDonnell and N. N. Wolpert; Membership Analysis (including character of, determination of interests and overlapping) C. F. Kayan and J. E. Haines; Meetings, M. F. Blankin and James Larkin; and Financial Analysis, F. H. Faust and E. R. Queer.

The committee is scheduled to meet again late in September.

ASHVE CHAPTERS

DEAR MEMBERS:

Many of our Chapters will start their new year of Chapter operations within the next few weeks. Some reflection, therefore, on the place of Chapters in our Society is in order.

Our Chapter operations represent one of the most important activities of our Society. Indeed, to many of our members who do not have an opportunity to attend the Annual and Semi-Annual Meetings or to serve on Society committees, the Chapter is the Society. Many members are inclined to evaluate ASHVE membership on the benefits received from Chapter affiliation. **It is important,** therefore, **that we have strong, active, purposeful Chapters as well as a vital, progressive and purposeful Society.** Each Chapter should adhere closely in its operations to the purposes and objectives of the Society. Each should consider itself an educational and scientific organization. Chapter activities should be evaluated on these bases:

1. Are they educational and scientific in nature?
2. Do they advance the arts and sciences of our industry and profession for the benefit of the public?

Chapter activities can probably be justified if they conform to both of these requirements.

Chapters also have a human and public relations value. The contact at the Chapter meetings provides an opportunity to become more intimately acquainted with the other local members of our profession and to discuss specific problems of mutual interest with them.

Chapters provide an educational opportunity for members to hear technical papers of both national and local interest and to participate in the discussions of important scientific and engineering subjects. Chapters may have on their programs subjects of technical interest that cannot very well be presented before the Society, possibly because the interest is local or because such papers do not meet the stringent professional requirements that must be maintained for papers presented at the Annual or Semi-Annual meetings.

Through our Chapters, many of our members are given an opportunity to take an active part in Society affairs and develop themselves for further service in the Society. The Chapter, thus, serves as a valuable training ground.

Chapters are valuable to the Society as a source of new members, and membership committees of Chapters should be continually on the lookout for new qualified members for the Society. **Through our Chapters we can impart to our members a better understanding of the Society's aims and purposes and accomplishments.**

Chapters can serve a very useful purpose by offering encouragement and recognition to the younger members of the Society and may do valuable work to improve the professional status of the younger men. Some of our Chapters are performing a great service by encouraging young men graduating from local high schools to study engineering and to prepare themselves for entry into the heating and air conditioning profession and industry.

Many of our successful members recall **the valuable aid and contacts made through their attendance at Chapter meetings** and how much valuable information they derived which assisted them on the road to success. Sometimes these same men lose interest in the Chapter activities after they have become successful and affluent, when they probably could do so much to inspire younger men and lend dignity to the Chapter and the profession by their continued interest. In some of our most active Chapters, the past officers continue to show an active interest in Chapter affairs.

The Chapter should be a credit to its community. **A strong, active Chapter will increase the prestige of the industry and the profession in the community.** Chapter members will be regarded with greater respect by other local professional groups, business men, and the public at large. Chapters should be public relations conscious and be more active in public relations work for the Society in their respective communities. Some further planning to accomplish this objective is under consideration.

The affiliation of a local Chapter group with an international organization serves to give the members of the Chapter a recognized professional status that they would not otherwise enjoy. In the community it gives a professional status and prestige to our particular branch of engineering. **ASHVE maintains its professional and scientific status on a high plane through the maintenance of rigid qualifications for membership, through its publications, its research, and other technical services.** The Society needs the Chapters and the Chapters need the Society.

The success of a Chapter depends on many things and not on any single activity. It is very important, however, for the Chapter officers to have a strong desire to develop a successful Chapter. They will then work toward its success and their enthusiasm will be imparted to other members of the Chapter. It is important that the Chapter officers become imbued with the purpose of the Society and that they regard their Chapter responsibilities as something more than an incidental duty.

The Officers and Council and some of our Society committees are studying ways and means of helping our Chapters in their operations. **The greatest contribution toward Chapter success, however, will come from Chapter members themselves through their continued interest and active support of their local Chapters.**

Cordially yours,

L. N. Hunter

PRESIDENT

Proceedings of ASHVE Semi-Annual Meeting at Swampscott

(concluded from August JOURNAL SECTION, p. 140)

WITH FINAL registration of 568, the 1954 Semi-Annual Meeting of the Society, held at the New Ocean House, Swampscott, Mass., set a record for a resort meeting.

Four technical sessions were held at which a total of 14 papers were presented and discussed. The entertainment events were well attended and provided some of New England's charm for the members and their families. (The first and second sessions and the meeting highlights were reported in the August JOURNAL SECTION).

THIRD SESSION, WEDNESDAY, JUNE 30, 9:30 A.M.

Second Vice Pres. John W. James called the meeting to order at 9:30 a.m. and introduced C. S. Leopold as chairman of the technical session.

Mr. Leopold called on H. M. Decker to present an abstract of the paper, Filtration of Microorganisms from Air by Glass Fiber Media, by H. M. Decker, J. B. Harstad, F. J. Piper and M. E. Wilson (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May 1954).

S. F. DUNCAN, Los Angeles, Calif. (WRITTEN): This paper is a distinct contribution to the literature on air cleaning. The authors show considerable restraint in reporting their tests since it takes painstaking care to evaluate the performance of filter media operating at the efficiencies found.

It is a bit surprising to see that the Type E glass filter paper tended to improve in collection of *S indica* as the velocity decreased, while the asbestos glass paper reacted oppositely. The authors attribute the increase in penetration at low velocity on the asbestos glass paper to the lower tendency for impingement at the lower velocity. Another explanation for the observed change in penetration on the asbestos glass paper could be the variable density of the material as shown in Fig. 7. Areas of low pack density would, at low average velocity, carry the bulk of the air, and hence give less opportunity for *S indica* to deposit on the fibers. At 20 fpm average face velocity more air will flow through the close-packed areas and improve performance as noted.

The fact that *S indica* is close to the size of a 1 micron sphere puts it in the range where Brownian movement can influence the path of the particle. Also, 1 micron spheres have a very short stopping distance and are difficult to impinge on any kind of a fiber. The combination of particle size and fiber size, together with the relatively constant penetration in the Type E glass fiber paper, leads toward the conclusion that particle collection is more influenced by diffusion than by velocity impingement. Hence, the suggestion that the increase in penetration through the asbestos glass paper at low velocity is due to non-uniform paper density is presented as a more likely explanation than that usually inferred by the wording of the authors' comment.

Second Technical Session gets underway with First Vice Pres. John E. Haines presiding, and Prof. G. L. Tuve, chairman

R. L. KUEHNER, York, Pa. (WRITTEN): The very fine progress the authors have recorded in this and preceding papers on air filtration is noted. The incorporation of heating devices for post-disinfection of contaminated filters is a unique and a very necessary development for the designed applications. Recent patent art shows that effort is being made by others to accomplish the same end for more general air conditioning use. These efforts have been largely in the direction of chemical disinfection either by incorporating a disinfectant in the new filter, or by chemically treating the filter immediately before removal and discard. Would the authors care to comment on whether or not they feel that such end-decontamination is necessary or desirable for the general field of air conditioning? Have they any indicators that the heat, chemical, or other method shows the greatest promise?

At first glance, the pressure drop through the two filters seems prohibitively great for general use. Fig. 9 in the paper suggests that the filters are physically amenable to the accordian-type mounting, similar to the cellulose-asbestos paper used in Atomic Energy Commission work. If so, practical pressure drop becomes a function of the amount of filter paper surface exposed, hence, overall size of the filter. Are data available on pressure drop per overall size of filter per volume of air, for example, at 500 cfm?

I would also like to ask for the authors' comments on several other problems in the general field of filter testing. In our work, we have found it desirable to use identical air sampling devices before and after the removal mechanism under test. In many cases this is not possible. For example, in the paper under discussion the number of bacteria before and after passage through the filter probably dictated the use of the impinger and the sieve device. Space limitations and pressure differences frequently cause similar inconveniences. In such cases the comparative collective efficiencies of two dissimilar devices must be determined. Do the authors have or know of a simple, standard or generally accepted method for comparing efficiencies of air sample devices?

Secondly, on what basis is the decision made to use wet or dry suspensions, bacteria carried on dust or in droplet nuclei, or other inocula in filter rating? Also of what importance is the size of the inocula? Is there general agreement on these questions?

Finally, what are the general criteria applied in the selection of the specific

General Chairman R. T. Kern presents a few remarks at Semi-Annual Banquet

organisms to be used in filter rating studies?

Author's Closure: Referring to the suggestion that some type of sampler should be used before and after the filter, Mr. Decker stated that in future tests this procedure would be adopted and has been made possible by the adoption of a different contaminating organism than was used in the previous tests. The author stated that answers to certain questions asked required security clearance, and consequently would be provided later for publication with the paper in the ASHVE Transactions.

The second technical paper, Effects of Room Size and Non-Uniformity of Panel Temperature on Panel Performance, by L. F. Schutrum and J. D. Vouris, was presented in abstract by Mr. Schutrum. Discussions were presented by R. C. Chewning, Portland, Ore., R. J. Mindak, Chicago, Ill., R. G. Vanderweil, Boston, Mass., C. M. Humphreys, Cleveland, Ohio, M. L. Ghai, Hartford, Conn. (complete paper and discussion published on pages 133-140 of this issue).

The third technical paper, Performance Data on Ceiling Panel Heating and Cooling, by R. J. Mindak and I. B. Fieldhouse was presented by Mr. Mindak.

I. W. Cotton, Indianapolis, Ind., presented the report of the Committee on Resolutions.

Resolutions

The ASHVE Semi-Annual Meeting now rapidly drawing to a close has established records and introduced innovations which merit appropriate acclaim, and it is therefore now

RESOLVED:

That the attending members of the Society, their families and guests, voice appreciation and acknowledge deep gratitude:

1. To Massachusetts Chapter for the genuine warmth of its hospitality;

2. To the Committee on Arrangements for its outstanding success in providing for our every comfort and pleasure;

Arranging so thoughtfully and meticulously, in advance, for air conditioning the entire area for our activities instead of limiting the salubrities to the rooms in which we have deliberated and gamboled;

Offering us humidities ranging from negligible to 100 percent to make it easy for our technical experts to expound our theories with full examples right there at hand;

Offering us an excursion which included an engine failure at sea for the edification of the uninitiated and permitted them to demonstrate the monumental calm which all such disasters should engender, and finally and most importantly in

Seeing to it that we always had skilled bus drivers on our excursions who navigated us through horrendous traffic hazards and brought us back to home base with miraculously whole skins and without benefit of life preservers.

3. To the New Ocean House Management and Staff for catering so delightfully to our culinary and refreshment urges and for furnishing spotless linens for our infrequent and regrettable lapses into repose;

4. To our Hosts for inviting such excellent speakers for the Welcome Luncheon and the Semi-Annual Banquet;

5. To the Officers of the Society, the technical staff, the Committee members, the research workers and speakers who cooperated in presenting interesting and significant papers and also to the members who spiced the Technical Sessions with questions and comments;

6. To the multitude of conscientious Committee Members who so intrepidly embraced stern duty and labored ever and anon in the Society and public interest in the face of beckoning and almost irresistible distractions;

7. To the welcoming host who proved to us over the loud speaker that the artistry of state or sectional ballyhoo can no longer be considered to thrive exclusively on its native Texas range; and last but by no means least

8. To everybody participating in this valuable and gala meeting for adding to the serious accomplishment and the grand good times by injecting their vivid personalities and inspiring friendliness into a get-together based on the zenith of human relationships — ASHVE service and camaraderie.

Respectfully submitted,
Resolutions Committee
I. W. Cotton, *Chairman*
Bruce W. Evans
John H. Ross

The fourth technical paper, Cooling Load from Sunlit Glass and Wall, by C. O. Mackey and N. R. Gay (complete paper published in *ASHVE* Journal Section, August, 1954) was presented in abstract by Professor Mackey.

G. V. Parmelee, Cleveland, Ohio, pointed out that the paper showed the ability of the fluid analogue to provide a visual representation of the operation of a real system. He inquired whether the authors had considered the use of a varying number of capacity tubes in the floor and ceiling circuits. He also asked about the time required for the system to reach a steady periodic state. He pointed out that in the authors' system the following three components had been combined: (1) the direct radiation transmitted through the glass, (2) the transfer from the glass to the space due to difference in glass and space temperature, and (3) the heat flow through the wall itself.

It would be very desirable to be able to apply a correction or reduction factor to each of these components of cooling load. It was apparent that the authors had determined the instantaneous heat gain as the sum of the transmitted radiation calculated from tables or other data, and the convection transfer from the inner surfaces of the air. Mr. Parmelee suggested that perhaps additional data could be obtained showing the effective heat transfer if the air in contact with the outside surface of the glass were allowed to vary in temperature.

R. W. McKinley, Pittsburgh, Pa., inquired whether the analogue could be used to determine the relative contribution to cooling load resulting from solar illumination and electric illumination when producing a uniform level of light in the space. If such information could be obtained it might establish a basis for control of electric lighting and window lighting in order to minimize the total load on the cooling system.

R. G. Vanderweil, Boston, Mass., referred to the authors' use of a motion picture showing the analogue in operation as a method of illustrating heat storage.

Mr. Leopold stated that his use of the hydraulic analogue (which had previously been used in other work) was based upon a desire to observe what was taking place in a system of heat transfer. The hydraulic analogue has an advantage in this respect, but requires more time for operation than an electric analogue. Where many tests are to be run it is probable that the electric analogue would be superior because of its time-saving features.

Author's Closure: Professor Mackey, referring to Mr. Parmelee's questions, stated that the analogue was used in connection with the Schmidt method of calculation in which a substance is divided into slabs, the number of slabs depending upon the accuracy desired. In the paper the floor thickness simulated was 1-in. concrete, but lesser thicknesses could have been simulated by using a greater number of tubes. The number of tubes used in the authors' solution was selected to give a sufficiently accurate solution.

In operating the analogue, it had been found that about 6 cycles would be required to reach a steady periodic state. The authors have additional information which was collected during the transient state period. Professor Mackey stated that while the components of cooling load were not shown, the instantaneous rate of heat gain from the glass and from the wall were shown in the tables.

Professor Mackey agreed that the application suggested by Mr. McKinley could be made.

In conclusion Professor Mackey stated that he had found the hydraulic analogue particularly useful in illustrating for students the complex heat transfer problem arising from unsteady state heat transfer. He also reviewed the method of determining the liquid heights or pressures, time, and the length and diameter of resistance tubes. It was stated that in the hydraulic analogue laminar flow must be used because the flow of liquid must be directly proportional to the first power of the pressure or height of liquid.

Mr. Leopold turned the meeting over to Second Vice President James who adjourned the meeting at 12:00 p.m.

FOURTH SESSION, WEDNESDAY, JUNE 30, 2:00 P.M.

Pres. L. N. Hunter called the meeting to order at 2:00 p.m. and introduced W. S. Harris, who presented an abstract of the paper, Cooling Studies in a Research Home, by W. S. Harris and P. J. Waibler (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, June 1954).

A. E. DIEHL*, York, Pa. (WRITTEN): Professor Harris presented data from this investigation at the recent All Industries Residential Air Conditioning Conference held in Chicago as a regular part of a panel presentation.

We note that this paper is rather definite in its conclusion that actual measured cooling loads were considerably below the calculated loads obtained using THE GUIDE. We believe that information of this type, along with *ARI* load calculation contained in *ARI* Standard 6-10 is proof that THE GUIDE figures should be abridged or extended for application to residential cooling loads.

This paper also contains some rather pertinent information with respect to operating costs and definitely outlines the effect of ventilation, outside air circulation during the night, etc. Some of the information contained in this paper might be used to supplement the paper on operating costs previously published,[1] in which operating cost was based on windows closed throughout the entire 24-hr period of the day.

It appears that Harris and Waibler have indicated advantages from rather conclusive data with respect to the effect of opening bedroom windows at night and shutting down the air conditioning system. They have also shown that some diffusion of air conditioning load can be obtained from one room to the next with a resultant rather low variation in dry-bulb temperatures throughout the residence by eliminating units in certain areas of the residence.

I believe that all these factors will eventually enter into the business of residential air conditioning and result in the low first cost and low operating cost that will be necessary if the industry is really going to sell a wide number of units.

E. P. PALMATIER and W. A. GRANT, Syracuse, N. Y. (WRITTEN): This is a very interesting paper because it demonstrates clearly that, regardless of the type of system used for a residence, the basic principles of good application practice cannot be compromised without incurring poor results.

Comparing Tests I and II, it is clear that circulation of too much air over the cooling coils results in unacceptably high humidities, and runs up the operating cost as well. From the data, it appears that 750 cfm should be ample, as compared with approximately 1350 cfm used in Table 1. However, the authors infer that the *number* of units operating is significant in relation to the quality of results, and that the fewer the units, the better the conditions.

This inference is incorrect. If the air quantity through each of the six units had been reduced to the correct value, good conditions would have been possible.

Correct conditioned air quantity to match the load, however, is only one significant item. In any system where cycling of the refrigeration equipment permits excessive rise of the refrigerating medium temperature during the off-cycle, high humidities are inevitable. This is so well known that it is surprising that the authors fail to point it out. The most straightforward way to insure satisfactory conditions of temperature and humidity in a residential cooling system is to match both air cooling capacity and refrigeration capacity to the load so closely that the equipment runs continuously during the hotter weather such as is represented in Fig. 5. Yet the bar chart of compressor operation shows less than 50 percent on-time during daytime and evening, and only about 30 percent on-time over the entire 24-hr period. With such gross oversizing of equipment with respect to the load, humidities of 60 to 75 percent, as actually occurred, can be expected.

Three-time winner Merrill F. Blankin (*right*) retires the Research Cup after accepting it from Sports Chairman W. G. Burbo

We would like to express a word of caution concerning opening windows for night cooling. The tests show average indoor night temperatures 4 to 5 deg *above* outdoors with windows open. This is fine for the tests cited where outdoor night temperatures dropped to 66 or 67 F, but that represents a 28 deg drop from the daytime maximum of 95 F. In most parts of the country, such a drop can certainly not be counted on. With outdoor night temperatures of 75 to 85 F, the indoor temperature will be far from comfortable.

The statement that the ventilation air increased the maximum load by only 25 percent is of considerable interest. If this load is calculated for the design outdoor conditions in Urbana, it amounts to 11,400 Btu/hr latent and 9,700 Btu/hr sensible, or a total of 21,100. If this were included in the design load calculations, it is evident that nearly two tons of refrigeration would be assigned to handle the outdoor air load alone. If the sensible load due to the outside air was increased by only 25 percent, then only about 20 percent of the air exhausted became part of the air conditioning load. This means that something like 90 cfm was drawn in through cracks in the bedrooms, living room, and probably also the dining room. The remaining 350 cfm was evidently drawn in through cracks around the kitchen window as well as around the door leading to the garage, and was discharged before its heat was absorbed by the room air. This implies that for a home of a certain *tightness* there is an upper limit to the amount of outside air load which should be included in the load calculations irrespective of the size of the exhaust fan. It is hoped the authors can be encouraged to pursue this important load component further.

The authors are to be commended for bringing to the attention of our membership important facts about the actual operation of residential cooling equipment.

---

*Chief Engineer, Commercial Products, York Corp.

[1] The Operating Cost of Residential Cooling Equipment, by S. F. Gilman, L. A. Hall and E. P. Palmatier (ASHVE JOURNAL SECTION, *Heating Piping & Air Conditioning*, April 1954, pp. 109-15).

F. W. Legler, Framingham, Mass., asked whether a saving might not be effected in operating cost by using the cooling water from the system for sprinkling lawns.

A. B. Newton, Wichita, Kans., inquired about the control of the water chiller and the relative capacity of the chiller and the room units. The difference in capacity might be expected to affect test performance.

I. S. Dane, Boston, Mass., requested information on the velocity of the air leaving the room units and its effect on the distribution of air within the room.

AUTHOR'S CLOSURE: Professor Harris was in general agreement with the comments made by Messrs. Grant and Parmelee. He stated that the circulation through the units was obviously too high, but that this was due to the necessity of selecting such units as were available rather than units especially adapted for residential use.

According to the equivalent temperature method of computing loads, the units were not over-sized. However, if the cooling load had been determined on a 24-hr basis such as that advocated by certain manufacturers, the units selected could have been smaller and would have had a capacity nearer the actual load.

Professor Harris stated that actual measurements had not been taken to determine the air introduced by means of the ventilation fans during the night. The calculated values were based on the free delivery value of the fans, and may not have been the true values.

With regard to Mr. Legler's comment, Professor Harris suggested that since restrictions are usually severe with regard to the use of cooling water from water supply systems, it would probably be necessary to use cooling towers or air cooled condensers for heat extraction.

Since the water chiller was of 2-ton capacity, it was obvious that it was oversize when only two-room units having a total capacity of 1 ton were in use. The compressor was started and stopped automatically to maintain a water temperature within a variation of about 4 deg.

Referring to Mr. Dane's question, Professor Harris stated that no drafts were noticeable in summer, although they were evident in winter. This was due to circulation of more air than was actually needed.

The second technical paper, Analogue Computer Analysis of Residential Cooling Loads, by T. N. Willcox, C. T. Oergel, S. G. Reque, C. M. toeLaer and W. R. Brisken, was presented in abstract by Mr. Willcox. Discussions were given by C. F. Kayan, New York, N. Y., S. F. Gilman, Syracuse, N. Y., R. J. Vanderweil, Boston, Mass., C. S. Leopold, Philadelphia, Pa., A. B. Newton, Wichita, Kans. (complete paper to be published with the paper in the ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning.*)

The last technical paper, Operating Cost of Residential Cooling Equipment, by S. F. Gilman, L. A. Hall and E. P. Palmatier (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, April 1954) was presented by Dr. Gilman.

R. C. CHEWNING, Portland, Ore. (WRITTEN): The effort to devise a method of predicting residential cooling costs reported in this paper is very timely in view of the increasing volume of residential cooling. The problem involved is vital to a large section of industry and is one in which the answers required are of grave concern to the public in order that they can properly evaluate the cost of owning and operating summer cooling systems which they might install.

Unfortunately, this discussion of the paper must be based on experience and tests with air conditioning systems in commercial buildings rather than residences. The types of buildings included in this experience are a 12-story office building with a very large percent of the exterior glass, a six-story 200-ft square building used as a newspaper office and publishing plant, and a bank building 50 x 200 with four floors plus a basement. These buildings are mentioned to illustrate the types of buildings with which the experience has been gained.

The correlation of data from flow meters and temperature recorders on the system serving the 12-story office building, with data on outside temperature, indicated that the only basis on which a relationship between heating requirements and outside temperature could be obtained was on a 24-hr average temperature basis.

No attempt was made to correlate cooling requirements with outside temperature, but indications were that the same principle would apply. This is in agreement with the authors' findings.

A. E. DIEHL, York, Pa. (WRITTEN): The authors have done a very good job in setting up a mathematical method of arriving at operating costs for residential air conditioning based on a degree-day basis. Information of this type is necessary and becoming more important every day in view of the fact that the Federal Housing Administration and its field agencies are requiring a statement with respect to operating costs along with an application for a loan on a residence containing an air conditioning unit.

This article should be qualified in that it deals entirely with the single compressor type of unit, and therefore the results obtained are based on actual data received on a single compressor series of installations. We raise this point because we believe that the use of two compressor units would result in reduced operating costs as compared with a single compressor type unit. The basis for our analysis is that the cooling load calculation which plays a very important part in Equation 8 which is used basically to establish operating costs is an integrated figure arrived at by calculating instantaneous values for various hours of the day and dividing by 24.

We, therefore, believe that the ideal approach would be to have a compressor capacity that would balance the instantaneous type of load obtained in a residence if the maximum efficiency with respect to operation costs is to be obtained. Although the two compressor unit does not approach this condition of an unlimited number of steps of capacity available, it does have the ability to operate at 50 percent capacity for a great period of the time. Therefore, we would suggest that this point be raised especially since the subject paper should not be considered as the final analysis on the method of calculating cooling operating costs.

If a unit is designed so that only half of the capacity is used when needed, operating cost reductions are naturally going to be secured. Unfortunately we do not have sufficient data with respect to operating times, etc. for various parts of the country, and therefore we cannot offer any concrete data at this time regarding two unit operation. On the other hand, it might be advisable to suggest to the authors of this paper that they consider including information in curve form to correct operating periods for the use of integral steps of compressor capacity for residential air conditioning.

F. R. ELLENBERGER, Bloomfield, N. J. (WRITTEN): The authors have presented an excellent paper on a subject of importance to the industry.

I would like to ask the authors if any attempt has been made to evaluate the accuracy of predicted power consumption with datum temperatures other than 70 F. For example, if t_d is taken as 75 F, the denominator of Equation 8 will be reduced — but so will the numerator because of the corresponding reduction in degree-days, D. It is possible that a datum temperature of 75 F would still be a reasonable match for the data collected in the field program described. An inspection of Fig. 4, for example, indicates that a line of slightly less slope and with an intercept at a higher value of t_a/t_m would perhaps be a better match for the data at the lower values of $TC/24H$. This brings up the question as to the validity of the least squares method which, although providing the best overall relation for the plotted points, gives undue weight to higher values of $TC/24H$, when the objective is to establish the intercept at $TC/24H = 0$.

A few years ago we conducted a field test program on packaged air-to-air heat pumps,† one of the objectives of which was to obtain accurate power consumption data. Data were automatically recorded at least once each hour, and cooling data were subsequently plotted in the forms of Btu per hour *vs* local outdoor temperature and kwhr/hr *vs* outdoor temperature. By this means it was possible to average data for each hour over an extended period of time covering one or more complete cooling seasons. Naturally, due to transient and cycling effects, the individual hourly points thus plotted exhibited a considerable spread, but when the kwhr/hr and Btu/hr values observed at each outdoor temperature were averaged over the extended test period, they showed an excellent match to a straight line. The equation for this straight line in the case of Btu/hr *vs* temperature is basically the same as Equation 8 of the present paper.

In all residential installations the intercept at zero capacity and power occurred very close to a temperature of 75 F. As would be expected, some hours were observed where cooling was required below 75 F, and the best match for all the data included a *hook* on the bottom of the straight line. However, the total hours of operation below 75 F were so few that seasonal averages were not materially influenced. On installations where the indoor fan was operated continuously during the summer, this *hook* was more pronounced in the kwhr/hr *vs* temperature plots. In all cases, however, no individual averaged point between 75 F and 95 F varied from the straight-line average by more than 2 deg.

It was tentatively concluded from the results of these tests that the effects on operating costs of solar heat gains were largely cancelled out over a number of hours. Over short periods of time, however, solar heat gains did, of course, have a material influence on cooling requirements; hence, for establishing installed capacity they could not be ignored.

If, then, when operating data are collected over long periods of time from many installations, it should be established that 75 F is a more typical datum temperature — or even if it is less valid than 70 F but still yields operating cost estimates within reasonable accuracy — then convenient use can be made of weather data already available.‡ This information is tabulated in the form of cooling degree-days above 75 F, and has been compiled for 227 locations throughout the U.S. The tabulations cover the years of 1898 to 1940 and give cooling degree-days for each month as well as for each year.

I have an additional question concerning the effect of *microclimate*, or the variations of weather conditions from one place to another within a given geographical area. It is not uncommon to find, particularly in hilly territory, local differences in average daily temperatures that are consistently 5 deg, or even as much as 10 deg, apart. Therefore, unless all of the test houses used in this paper fortunately had about the same temperatures as the nearest Weather Bureau Station, the facts that led to the conclusion that a maximum error of 8 percent in predicting operating hours of cooling equipment was justified, may have been, to some extent, fortuitous. In other words, if the actual degree-days experienced at a given spot can vary more than 8 percent from the degree-days observed at the nearest weather station, it would be impossible to obtain a precision of 8 percent when Weather Bureau degree-days are used to predict operating costs.

One final observation I would like to offer is that it is not necessary to use only the so-called 24-hr estimating method for evaluating H and t_m in Equation 8 to arrive at an estimate of operating hours. Any accurate method of calculating average heat gain at a given outdoor temperature should suffice. The need for a heat gain and temperature estimate is to establish for a given structure the slope of the line which defines average heat gain *vs* outdoor temperature.

H. T. Gilkey and D. R. Bahnfleth, Urbana, Ill. (Written): This paper represents the first step in the solution of a problem which has become very important in the field of residential air conditioning. Although the final results present a consistent picture of datum temperature and operating cost, it does not seem that a study of only 11 residences can be used to establish the datum temperature for estimating residential cooling costs. Future work may show that the results of this study are entirely reasonable. Other work must be done, however, and many more residences must be studied before this datum can be definitely established.

A very interesting aspect of the problems encountered in residential air conditioning is shown in Fig. 2. It may be noted from Table 1 that the nominal cooling unit capacity of the equipment in Residence No. 1 is five tons. Yet the information in Fig. 2 indicates that the outdoor wet-bulb temperature would have to drop below 40 F before the cooling unit capacity would reach this value. Furthermore, in Atlanta, Georgia, the location of the residence, the outdoor design conditions are 98 F dry-bulb and 76 F wet-bulb temperatures. With a 76 F wet-bulb temperature, the capacity of the cooling unit would be approximately four tons of refrigeration instead of the rated five tons. It should be mentioned that the performance of this equipment is typical and that even when water conservation methods are not applied, it has been found that the actual cooling unit capacity is usually below the rated capacity. This situation causes one to wonder if the rating methods are not misleading as well as unrealistic.

The statement is made in the paper that when t_a, the mean temperature for a day, equals t_d, the datum temperature, the net load over a 24-hr period will be zero. The paper then continues that since the solar and internal components represent heat gains, the infiltration and transmission components must be heat losses. This is a little mystifying since usually the cooling unit at some time during the day removes some heat. Perhaps one is to infer that this statement applies only to a residence which is not being cooled by refrigeration. It is agreed, however, that the outdoor temperature is only one of the factors which contribute to the cooling load of a residence. Because it is felt desirable to use outdoor temperature as a basis for predicting operating costs, it is reasonable that the datum temperature would be lower than the control temperature within the residence.

A reference is made in the paper to a 48-day test conducted at the University of Illinois. The authors state that the datum temperature for this study was 71.1 F. Apparently, the authors have not had complete information since a preliminary analysis of the data indicates that the datum temperature should be in the vicinity of 65 F for this study. It is hoped that within the near future more complete information will be available on this phase of the work at the University, and that the period covered in the report can be longer than the 48 days mentioned in this paper.

One of the questions which occurs regarding the results of this study concerns the weather data used to determine the predicted values shown in Table 3. In order to get the good agreement shown in the table, it is probable that the weather experienced during the test period for each house was used to obtain the predicted operating time and power cost. One then wonders how the weather during this period varied from so-called seasonal weather for the same localities. Before the authors' assurance that the predicted costs will be within ± 8 percent or $10.00, whichever is greater, can carry much weight for the home owner, it would seem that a *normal* season should be defined for each locality.

It is hoped that the authors and others will continue this very important work. Much more information is needed so that all variables such as climate, type of construction, method of cooling the condenser, etc., can be considered. In addition, attention should be given to the development and publication in The Guide of a method of residential cooling load calculation. This move would permit future work in residential air conditioning to be reported on a uniform basis.

C. M. toe Laer, Bloomfield, N. J. (Written): The study reported in the paper is a very interesting one, and the conclusions may be substantiated by further observations. The present study was limited to 11 houses, two of which were studied for only two weeks and four for less than two months.

---

†Evaluating Heat Pump Performance by F. R. Ellenberger, A. B. Hubbard, W. R. Foote, F. Burggraf and J. J. Martin Jr. (ASHVE Transactions, Vol. 56, 1950, p. 87).

‡U.S. Weather Bureau Forms DD-2AC.

Younger set at Semi-Annual Banquet (*l. to r.*) Judy Blankin, Ted Roche, Willette Wallace, Peter Maves, Barbara Seeley, Mike Noble

(Pictures throughout Proceedings furnished through courtesy of W. M. Wallace, II, Durham, N.C.)

Residence No. 8 had an operating cost of $40.42 higher than the method anticipated or 25.37 percent above that predicted.

In Residence No. 11 the customer would have less reason to complain because the power consumption was 11.9 percent less than predicted. Another interesting observation is that houses No. 9 and No. 10 in the same city were 12 percent high and 8 percent low respectively. When one examines the extreme deviations and observes a 37 percent difference from values predicted between the high and the low, the conclusion might be drawn that the samples were too limited to attempt to substantiate the procedure.

It might be possible that consideration of other factors such as (1) percent sunshine hours, (2) wet bulb temperatures and their effect on comfort temperature, (3) the desired indoor temperature, and, (4) the sensible capacity of the equipment with respect to load, would give more accurate results. A method given in an article by T. N. Willcox in the June 1954 issue of *Fuel Oil News* gives estimated operating hour figures for various cities based on these other factors which seem to have a major bearing on operating cost.

Other factors that also have a bearing on operating hours are type of construction, and the user's living habits, particularly his desires regarding the use of outdoor air for night cooling. The method used by the authors includes only one of the factors — outdoor temperature, and uses the average daily temperature rather than the number of hours when the temperature is above a predetermined point. I believe we all accept the fact that lower indoor temperatures in summer mean higher operating cost just as higher temperature in winter increases operating costs. An analysis of United States Weather Bureau data for any city will show considerably more hours above 75 F than above 80 F. This is not a straight line function as summer weather can be plotted on a probability curve with good results. This factor has also been neglected in the method outlined.

The use of a 70 F datum temperature on the basis that a house remains at 5 deg above outdoor temperature over a 24-hr period without air conditioning does not seem to me to be justified because during the hours when air conditioning is required, the house (without air conditioning) is normally at or below outdoor temperature.

It is also noted that owners were asked to keep their thermostats between 72 and 75 F (average 73.5). I question the assumption and use of such a low indoor temperature (and a fixed temperature as a basis) because the user preference survey reported in the previous paper indicated a general desire for higher temperatures.

The use of such a low temperature could make for reasonably consistent, though not conclusive, results because the lower the indoor temperature on which the load is calculated, the less the percentage effect of internal loads and solar load. A basic error in the method, I believe, is that it assumes that loads which are independent of temperature difference are a function of temperature difference.

Although there may be some basis for using a 24-hr integrated load for the estimating of operating cost, it would seem to me that a separate load calculation for this purpose represents unnecessary additional work for the contractor. The industry has accepted sizing procedures which consider the four to six hour average peak load. The paper□ just presented on analogue computer analysis further substantiates this procedure.

The industry and the United States Weather Bureau must work together to arrive at suitable factors to be applied for computing operating cost based on the established cooling load calculation procedures.

AUTHOR'S CLOSURE: L. A. Hall, referring to Mr. Gilkey's comments, stated that there would be no operation of the cooling system when the average dry-bulb temperature is the same as the datum temperature. Under this condition solar and internal loads constitute heat gains, and must be balanced by equivalent losses.

While Mr. Gilkey recommended a datum temperature of 65 F and the authors of another paper, Analogue Computer Analysis of Residential Cooling Loads, recommended a datum temperature of 75 F it was apparent that the authors of this paper had arrived at a happy medium by selecting 70 F.

With reference to Mr. Chewning's comments on commercial buildings, Mr. Hall stated that such buildings would probably have lower datum temperatures because of the higher internal heat loads due to people and lighting.

Mr. Diehl had suggested that operating costs might be significantly lower if 2-compressor units had been used. The authors had not been able to investigate such operation up to the present time.

Referring to Mr. Ellenberger's comments, Mr. Hall stated that no attempt had been made to relate the power consumption to a datum temperature other than 70 F. Mr. Hall agreed with Mr. Ellenberger that the method of least squares for determining curve points placed more weight on values at the higher points, but this seemed reasonable to the authors because the greater amount of operating time was obtained at these higher temperatures.

In order to be able to use weather data from available Weather Bureau stations, the residences tested by the authors had been selected as near as possible to existing Weather Bureau stations.

The authors recognized the desirability of obtaining data from very frequent observations, but due to difficulties encountered in occupied houses had adopted the method described for the tests reported. It was, however, possible in the case of two residences tested in 1952 to obtain test information by continuous records giving minute by minute results if desired.

Referring to Mr. toeLaer's comment regarding the large difference between actual and computed load for Residences 9 and 10 in the same locality, Mr. Hall stated that when an original error had been found and corrected in the calculation of the load for Residence 9, both Residences 9 and 10 were found to have loads within 1 percent of the predicted values.

In conclusion, Mr. Hall reported that in a survey made by the *American Gas Association* on 325 people and homes, the thermostat settings were found to be set at 75 F or lower in about 50 percent of the homes, and the majority between 74 and 76 F.

The authors did not feel that the value of 70 F adopted as a datum would necessarily be the final value since further experimentation might indicate a better value.

President Hunter announced the total registration as 568. As there was no further business, the Semi-Annual Meeting of 1954 was adjourned at 4:30 p.m.

□Analogue Computer Analysis of Residential Cooling Loads, by T. N. Willcox, C. T. Oergel, S. G. Reque, C. M. toeLaer and W. R. Brisken (to be published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*).

What We Are Doing About Air

By William O. Huebner, Chairman*

One of the Society's most important contributions to the advancement of applied science has been the development of reliable design information for air distribution systems. It is the result of basic research on the behavior of air streams conducted at the Society Research Laboratory and cooperating institutions such as Case Institute of Technology, Kansas State College, and Michigan State College.

ASHVE Research Laboratory

Studies on isothermal and non-isothermal ventilation jets are being continued at the Research Laboratory in a long-range program. These studies are remarkable for the great number of difficult observations made with sufficient accuracy to define performance and develop generalized relationships. They introduced the concept of turbulence as a quantitative factor in air distribution, which resulted in the development of several simple, reliable instruments for measuring low air velocities, and for establishing flow patterns and velocity directions. A comprehensive survey of the entire literature on air distribution made in connection with the project permits study of the problems without requiring recourse to the original papers and is, therefore, a unique tool for every researcher in air distribution.

Case Institute of Technology

Research at Case Institute of Technology is concerned with air velocities in ventilation jets. This is also a long-range program on the behavior of free air streams and outlet performance. These valuable studies in the analysis of air distribution problems have furnished many answers to questions on outlet performance. As a result of these studies it is now possible to predict the performance of isothermal ventilating jets from various types of outlets, and to compute temperatures and velocities in vertical jets of hot or cold air.

Kansas State College

Research at Kansas State College deals with downward travel of air jets in what is undoubtedly the first quantitative investigation of the behavior of such jets of heated air from vertical discharge unit heaters.

Michigan State College

Studies of the resistance of rectangular fittings which divide air streams are being carried on at Michigan State College. In an effort to make consistent designs, and to reduce the resistance of dividing fittings, engineers have designed a wide variety of shapes of branch take-offs to accomplish the desired division. The variety has undoubtedly been prompted by differences of opinion of the designers concerning the major cause of resistance. Some designs emphasize the use of a complete elbow for a branch; others appear to attempt to split the trunk stream at a proper position, while still others seem to aim at velocity control by influencing the expansion or contraction of the streams where necessary. A study of the performance of these dividing fittings should lead to a better design as well as a simplification in the number of types of such fittings.

Useful Basic Data

Twenty-six papers on air distribution and ten on air duct design have been presented to the Society as a result of the foregoing research projects, and in addition, design information based upon the data in the papers has been used to amplify and improve THE GUIDE chapters on Air Distribution and Air Duct Design.

The Technical Advisory Committee on Air Distribution has been active in planning, reviewing and coordinating past research projects, and is continuing to develop programs for increasing the fund of information on new developments such as high velocity distribution of air in confined and open spaces, and the performance of supply outlets as affected by location and type of outlets and the temperature of the air.

A Pitot tube study undertaken for the *National Association of Fan Manufacturers* is expected to lead to an investigation of the characteristics of small Pitot tubes under the guidance of the Committee.

The results already achieved not only make it possible to improve the design and performance of present systems, but also stimulate those who participate in Society-sponsored research to establish higher objectives for future accomplishments.

---

*ASHVE Technical Advisory Committee on Air Distribution

C. H. B. Hotchkiss

Hotchkiss and Vidulich Join Society Staff

The Officers and Council are pleased to greet two new staff members at Society Headquarters. Due to the Society's growth, and the expansion of technical services that has been authorized, more editorial assistance and public relations, publicity and promotion work is essential. This need will now be satisfied by the appointment of Messrs. Hotchkiss and Vidulich.

W. M. Vidulich

Charles H. B. Hotchkiss, Ridgewood, N. J., joined the Society's staff at the headquarters office August 1 as editor of the Society's JOURNAL. Among his other responsibilities will be the publication of the TRANSACTIONS and other technical bulletins. Mr. Hotchkiss received his engineering education at Penn State College, where he was granted his B.S. in 1918 and M.E. in 1924. He joined the Society in 1927 and served actively on many of its technical committees, among which are the TAC on Radiation, TAC on Sorbents, Guide Committee, and as chairman of the Publication Committee and the Committee on Admission and Advancement.

He has had extensive experience in the publishing field as well as in engineering, having served as editor of *Heating and Ventilating*, 1930 to 1940. After two years Army Service and two years with the Pennsylvania State Highway Department, he joined the staff of Penn State College and taught mechanical engineering. He also served on the staff of the engineering experiment station. He then transferred to Purdue University and was assistant professor of heating and ventilating in the School of Mechanical Engineering until 1930. In 1940 he became vice president of Ameresco Inc., New York, which specialized in exporting heating, air conditioning and other engineering equipment. In 1950 he organized Endeco which engaged in work on top classified subjects related to radar and sound transmission devices. For the past two years he has been with H. K. Ferguson Co., working in New York on large industrial plant design and construction of a Canadian project.

Mr. Hotchkiss holds membership in *ASME, American Society of Engineering Education, National District Heating Association,* Alpha Chi Rho, Phi Kappa Phi, Tau Beta Pi. He is a registered professional engineer in the State of New York.

William M. Vidulich of Fairlawn, N. J., joined the headquarters staff of the Society on August 16 and his responsibilities include the direction of public relations, publicity and promotion activities.

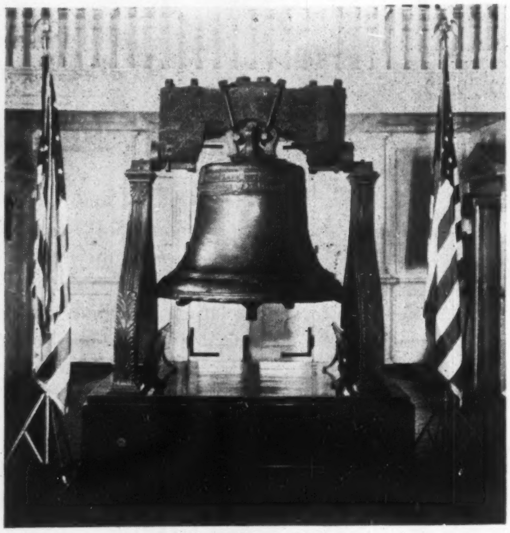
In assuming this position with ASHVE, Mr. Vidulich leaves Oildom Publishing Co., Bayonne, N. J. where, since 1950, he has been advertising and sales promotion manager of *Fuel Oil News*, a national trade publication serving the automatic oil heating industry. Through this association he is well known in the heating industry because of his various activities cooperating with the members and officers of the *Oil-Heat Institute of America*, the American Petroleum Institute Oil Industry Information Committee and the educational program of the *New Jersey Oil Heat Council*.

Prior to 1950, Mr. Vidulich was Associate Editor of the *Official Bulletin* of the *Heating, Piping and Air Conditioning Contractors National Association*, New York, where he worked under the direction of Joseph C. Fitts, former National Secretary of the Association, on publishing and public relations problems.

Since 1937, Mr. Vidulich has been engaged in the advertising, public relations, and newspaper fields, except for the period 1942-45 when he served in the U. S. Army Signal Corps in the European theater as a war photographer and an administrative NCO. He has been active in veterans organizations and served as Commander of Ridgewood Post 53, American Legion and is also past county officer of the Legion of New Jersey. Following his war service, Mr. Vidulich was an account executive with Shivell Advertising Agency and prior to entering the military service, he was a member of the advertising staff of the *Ridgewood Herald News* for five years.

JOURNAL SECTION

Liberty Bell Summons ASHVE Members To 61st Annual Meeting



The Liberty Bell

PHILADELPHIA, America's third largest city in the country's third largest state, will be the site of the Society's largest Meeting and largest Exposition. The 61st Annual Meeting of the Society will be held in the "City of Brotherly Love," January 24-27, 1955. Meeting headquarters will be in the Bellevue-Stratford Hotel.

B. H. Spurlock, Jr., chairman of the Program and Papers Committee, has announced that a well-rounded program of technical sessions is planned for the Meeting at which papers on a wide variety of heating and air conditioning research and developments will be presented.

The Committee on Arrangements, headed by John W. McElgin and John Everetts, Jr., general chairman and vice chairman, respectively, has already completed preliminary plans for a full schedule of entertainment. The program will get underway on Sunday afternoon with a Welcome Tea at the Bellevue-Stratford.

On Monday the members and guests will receive Philadelphia chapter's official greeting. Features of the Monday night get-to-gether will be announced soon by the Entertainment Committee. The Meeting will be climaxed on Wednesday night with the 61st Annual Banquet at which the featured speaker will be Dr. Milton S. Eisenhower, president, The Pennsylvania State College.

For the ladies there will be several interesting trips, a luncheon, style show, and theater party.

In conjunction with the Meeting, the Society is sponsoring the 12th International Heating, Ventilating, Air Conditioning Exposition to be held at the Commercial Museum in Philadelphia, January 24-28, inclusive. The International Exposition Co., manager of the show, has announced that nearly 400 exhibitors have already reserved space, which will make this the largest show of its type ever held.

Exposition Hours

Monday	Tues. through Thurs.	Friday
12:00 noon	11:00 a.m.	11:00 a.m.
6:00 p.m.	10:00 p.m.	6:00 p.m.

Philadelphia, Cradle of Liberty, and the Philadelphia Chapter are looking forward to welcoming Society members, their families and friends to the City of "Brotherly Love" in January. Plan now to attend this Meeting. Prompt return of the hotel reservation form sent to all members in August is advisable. These should be sent to the Housing Bureau for the 61st Annual ASHVE Meeting, Architect's Building, Philadelphia 3, Pa.

Philadelphia Committee on Arrangements
61st Annual Meeting
January 24-27, 1955

John McElgin, *General Chairman*
M. F. Blankin, *Honorary Chairman*
John Everetts, *Vice Chairman*

Committee Chairmen

Reception: J. O. Kirkbride
Entertainment: E. K. Wagner
Banquet: H. B. Prewitt
Ladies: E. H. Dafter
Finance: P. H. Yeomans
Transportation: G. W. Powell, Jr.
Sessions: A. M. Robertson
Exposition: C. F. Dietz
Publicity: Ludwig Mack

Honored by Life Membership

Joseph W. Brinton — Manager, Boston District, American Blower Corp., Boston, Mass. Mr. Brinton was born in Delaware County, Pa., on January 5, 1889. He studied mechanical engineering at Pennsylvania State College and was graduated with an M.E. degree in 1912.

J. W. Brinton
Boston, Mass.

In June of the same year, Mr. Brinton went to work for the American Blower Co. and has been connected with that company ever since. He did sales work in the offices in Detroit, Philadelphia, and Baltimore, and since the end of World War I has been located in Boston. While on leave from the company for two and a half years, he served in the Quartermaster Corps of the U. S. Army.

A member of ASHVE since 1920, Mr. Brinton is an active member of the Massachusetts Chapter and served as its president in 1941. He was a member of the Reception Committee for the Semi-Annual Meeting in Swampscott.

●

George Nelson, Ackley, Ia.—Since 1918, George Nelson has been connected with the Carstens Brothers firm, Ackley, Ia., as engineer and estimator. In this capacity, he supervised work on such diverse projects as the U. S. Naval Training Station, North Chicago, Ill.; Grinnell College, Grinnell, Ia.; and the City Central Power and Heating Plant, Buenos Aires, Argentina.

Previous to joining Carstens Brothers, Mr. Nelson had worked for four years as superintendent of construction and installation for the C. F. Rock Plumbing and Heating Co., St. Joseph, Mo.

George Nelson
Ackley, Ia.

Born in Copenhagen, Denmark on June 28, 1884, Mr. Nelson became an ASHVE member in 1923.

●

Ray L. Spitzley, Detroit, Mich.—Founder and president of the R. L. Spitzley Heating Co., Detroit. After graduating with a degree in mechanical engineering from the University of Michigan in 1911, Ray L. Spitzley was employed by the Continental Motors Corp. in Muskegon, working up to engine tester. In 1914, he joined the A. J. Smith Construction Co., Detroit, where he was successively an estimator and outside superintendent. One year later, Mr. Spitzley entered a partnership, the Spitzley-Wiedeman Construction Co.

Then, on Armistice Day in 1918 the R. L. Spitzley Heating Co. opened. Under Mr. Spitzley's supervision, the company has undertaken such projects as the Engineering Building for the Ford Research Center and City-County Building for the City of Detroit.

A past president of the *Heating, Piping and Air Conditioning Contractors National Association*, Mr. Spitzley was honored by that organization with its Distinguished Service Award for 1954. He also holds membership in the *Engineering Society of Detroit, American Society of Military Engineers, Detroit Board of Commerce* and *American Society of Sanitary Engineers*. Mr. Spitzley's sons, Ray Lester and Joseph Henry, are both ASHVE members and important factors in their father's firm.

R. L. Spitzley
Detroit, Mich.

●

Ernest Szekely — President, Bayley Blower Co., Milwaukee, Wis. Past Pres. Ernest Szekely was born in Debrecen, Hungary, on July 24, 1888. Graduated from the University of Budapest in 1910 with an M.E. degree, Mr. Szekely remained as an assistant professor at the University.

After coming to the United States in 1912, there followed a progressively successful career as designer for Guarantee Construction Co., N. Y.; research engineer for American Blower Co.; consulting mechanical engineer; chief engineer for Drying Systems, Chicago, and Bayley Blower; and president of Bayley Blower since 1932.

Mr. Szekely joined the ASHVE in 1920, and has served in many capacities since 1922. He has held all the leading elective offices, serving as president in 1952. At present, he is a member of the Society's Advisory Board. He was also honored by election to the presidency of the Northern Ohio and Wisconsin Chapters.

Ernest Szekely
Milwaukee, Wis.

The author of numerous engineering articles, Mr. Szekely is a member of the *American Society of Mechanical Engineers*, the *Wisconsin Society of Professional Engineers*, Tau Beta Pi, Pi Tau Sigma, and the *Engineering Society of Milwaukee*, which he served as president.

William T. Walters, Chicago, Ill. —Mechanical engineer, George W. Hubbard and Associates, Consulting Engineers. Schooled in South Wales where he was born, Mr. Nelson received the University of Wales' scholarship in metallurgy, and served a seven year apprenticeship before coming to this country. Here, he began with the Illinois Central Railroad as draftsman, and then acted in turn as apprentice instructor, special machinist and mechanical assistant to the engineer of buildings. Later, at Kehm Brothers Co. he participated in the early stages of force flow hot water heating. Mr. Walters acted as engineer and estimator for a number of firms before entering his present position.

W. T. Walters
Chicago, Ill.

Author of the *American Technical Society* textbook, *Steam and Hot Water Fitting*, Mr. Walters is a member of the *Universal Craftsmen Council of Engineers.*

H. G. Strong in New Executive Post

Announcement is made of the appointment of H. G. Strong, Syracuse, N. Y., as executive secretary of the *Refrigeration Industry Safety Advisory Committee*, whose headquarters are being transferred from New York to Washington, D.C. They will be located in the same space occupied by the *Air-Conditioning and Refrigeration Institute*, at 1346 Connecticut Ave., N. W.

This Committee is sponsored jointly by the *Air-Conditioning and Refrigeration Institute*, the *Compressed Gas Association, Inc.*, and the *National Electrical Manufacturers Association.*

H. G. Strong
Syracuse, N. Y.

Mr. Strong, a member of ASHVE, brings to his new assignment a wealth of experience in engineering and application of air conditioning and refrigeration equipment, having spent 25 years with the Carrier Corp. in the field and operating out of the home office in Syracuse. He has served for several years as Chairman of the *Refrigeration Industry Safety Advisory Committee* and thus is very familiar with its objectives and its results to date.

Mr. Strong succeeds M. D. Miller, who has resigned as executive secretary of *RISAC* to join the staff of the *National Electrical Manufacturers Association.*

John R. Allen Memorial Library

The ASHVE Committee on Research gratefully acknowledges the following gift to the John R. Allen Memorial Library, which is maintained at the Society's Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

Climatological Atlas of Canada, prepared by Morley K. Thomas and published jointly by the Division of Building Research, *National Research Council*, and the Meteorological Division, Department of Transport, Canada. Gift of the Division of Building Research, *National Research Council*, Canada.

The presentation of textbooks and pamphlets in the field of heating, ventilating and air conditioning and allied fields, by authors and others, will be welcomed by this library. Suitable book plates carry the name of the donor and date of the gift.

Summary of Chapter Meetings

• *INDIANA*: The Lincoln Hotel in Indianapolis played a prominent role at the May meeting. After dinner in the Travertine Room, W. F. Currise, program committee chairman, introduced Guard Savage, from the consulting firm of Bevington, Taggart & Fowler, who gave an interesting talk on the design problems for air conditioning the Lincoln Hotel, and the reasons necessitating the selection of a high pressure distribution system to properly air condition all the rooms. A tour of the mechanical installation and guest rooms followed.

A unanimous vote carried the new slate of officers: *President*—P. O. Patterson; *Vice President*—J. W. Jackson; *Secretary*—A. O. Roche, Jr.; *Treasurer*—F. B. Morse; *Board of Governors*—R. C. Blackman, W. W. Grear and G. W. Vogel. Also elected were the nominating committee members for next year: W. R. Fenstermaker, C. F. A. Locke, T. R. Davis, J. T. Hardin and I. W. Cotton. Pres. R. C. Blackman particularly complimented the work of D. C. Fulk, attendance committee, and A. G. Allen, announcements committee. Purdue Student Branch members present at the meeting were introduced. Attendance 61.

• *NEBRASKA*: A group of Eagle Scouts who have specialized in giving various full dress American Indian dances entertained the members and guests at the June meeting.

K. E. Martin, chairman of the nominating committee, reported the 1954-55 election results: *President*—C. A. Goth; *Vice President*—T. E. Davis; *Secretary*—L. J. Paulsen and *Treasurer*—F. E. Hawley. The president's gavel was presented to Mr. Goth by outgoing Pres. O. J. Smith, who offered his encouragement to the new president. Attendance 60.

• *NORTHERN OHIO*: Officers elected for the next term were: *President*—D. E. Mannen; *Vice President*—L. C. Burkes; *Secretary*—H. R. Canoyer; *Treasurer*—R. E. Leising; *Board of Governors*—J. M. Black, Sherwood Nassau and W. F. D. Neiheiser.

L. H. Jackett, program committee, introduced the guest speaker for the May meeting, C. W. Nessell, Minneapolis-Honeywell Regulator Co., Chicago, who discussed the early history of warm air heating and the latest design practices regarding perimeter heating. Attendance 67.

• *SACRAMENTO VALLEY*: The necessity for periodic maintenance was stressed by the guest speaker for June, S. F. Duncan, director of research, Farr Co., Los Angeles, in his talk on the design and application of evaporative coolers.

V. W. Thornburg announced improvement in the treasury balance; E. C. McKinsey spoke on the Joint Engineering Council, and J. D. Kniveton reported on Golden Gate Chapter activities. Election results were as follows: *President*—J. E. Marshall; *Vice President*—R. A. Sarro; *Secretary*—V. W. Thornburg; *Treasurer*—M. J. Delavan; *Board of Governors*—N. W. Downes, L. A. O'Meara and E. C. McKinsey.

• *SOUTH TEXAS*: Ten past presidents attended the May meeting as Reg. F. Taylor installed the new officers: *President*—J. W. Holland; *Vice President*—F. M. Neil; *Secretary*—J. C. Lewis; *Treasurer*—O. G. Rivoire; *Board of Governors*—A. B. Ullrich, Jr. and R. S. Sandifer. Mr. Taylor complimented Pres. E. G. Floeter, Jr., and his officers on their success this past year, including the Annual Meeting. After the reading of the various committee reports, J. W. Holland accepted the gavel. Attendance 74.

• *UTAH*: Pres. M. L. Gollaher conducted the May meeting at the Newhouse Hotel and introduced A. A. Maycock, newly elected president. Mr. Maycock discussed the future of the heating and air conditioning industry and some of the problems of the Utah Chapter. Attendance 8.

ILLINOIS CHAPTER PAST PRESIDENTS MEET

Twelve of the past presidents of the Illinois Chapter met for the group's annual dinner, at the Merchants & Manufacturers club in Chicago. S. R. Lewis was again reelected *president of the past presidents' club* and H. G. Chapin, who was out of town, the junior past president, was named secretary of the group, succeeding M. W. Bishop.

Others attending the dinner were E. P. Heckel, Harry M. Hart, S. I. Rottmayer, W. A. Kuechenberg, A. O. May, C. M. Burnam, Jr., James H. Milliken, Charles E. Price, P. J. Marschall and Robert E. Hattis.

Purpose of the informal past presidents' club is strictly social. While the past presidents of course see each other during the year at regular meetings of the Illinois Chapter, and on other occasions, they gather as a group for dinner annually.

JOURNAL SECTION

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the Journal of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 57 applications for membership, including 1 student application and 1 reinstatement; in addition 10 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by September 30, 1954, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement.

California

Danielson, E. P., Chief Engr., Air Conditioning Co., Inc., Glendale. References: I. P. Fulmor, A. J. Hess, R. F. Pyle, K. D. Simon.

Stern, B. P., Vice Pres. & Secy., Air Conditioning Co., Inc., Glendale. References: I. P. Fulmor, A. J. Hess, Stanley Polland, R. F. Pyle.

Terry, S. W., Asst. to Chief Engr., Aladdin Heating Corp., San Leandro. References: W. W. MacLean, J. D. Mitchell, H. G. Smith, S. W. Terry, Sr.

Connecticut

Faller, James H., Project Engr., Tuttle & Bailey, Inc., New Britain. References: L. W. Helenski, W. L. Lipski, C. O. Mackey, R. D. Tutt.

Guiles, W. L., Mgr., Technical Sales, Flexible Tubing Corp., Guilford. References: Lester T. Avery, R. B. Darling, Raymond Mancha, G. V. Zintel.

Florida

Dooley, J. W., Owner, Jess Dooley's, Leesburg. References: George Collins*, Fred Kane*, D. L. McDuffie, G. E. Taylor, Jr.

Georgia

White, A. O., Jr., Cons. Engr., Atlanta. References: W. M. Garrard, E. W. Klein, Jr., F. H. Nelson, Peter Van Dae, Jr.

Idaho

Bonner, H. R., Owner, City Plumbing & Heating, Kellogg. References: R. B. Campbell, J. L. Harvey, R. D. Lane, T. P. Nau.

Lane, R. D., Pres., Lane Inc., Kellogg. References: R. B. Campbell, James Doyle, J. L. Harvey, K. M. Wood.

Illinois

Iseminger, C. P., Mech. Engr., William Goodman, Chicago. References: M. E. Fine, William Goodman, H. M. Hymen, A. J. Sander.

Joerger, G. L., Mech. Engr., Deleuw-Cather Co., Chicago. References: M. J. Bamond, Gordon Haberer, R. E. Hattis, E. E. Sundeen.

Salzman, W. B., Building Mech. Engr., Illinois Bell Telephone Co., Chicago. References: J. S. Kearney, J. H. Milliken, H. J. Seetch, A. G. Stout.

Valentine, D. M., Dist. Mgr., Surface Combustion Corp., Park Ridge. References: S. E. Fenstermaker, Jr., M. C. Greiner, A. J. Hess, G. V. Zintel.

Indiana

Hatop, J. F., Vice Pres. & Gen. Mgr., E. J. White, Inc., South Bend. References: H. A. Burkart, Jr., W. A. Fenstermaker, J. W. Jackson, G. B. Supple.

△Pfau, A. C., Partner, Pfau-Vogel Co., Indianapolis. References: R. C. Blackman, E. G. Fowler, H. J. Noles, Arthur Nutting.

Kentucky

Kline, J. L., Engr., American Air Filter Co., Inc., Louisville. References: W. J. Killian, J. W. May, R. W. Nelson, C. S. Stock.

Louisiana

Gambel, C. L., Pres., General Heating & Air Conditioning Co., Inc., New Orleans. References: Stanley Lecourt*, Richard Schaffner*, Nat Totten*, W. Zigler*.

Massachusetts

Hooper, A. A., Sr. Mech. Engr., Jackson & Moreland, Boston. References: H. J. Nickel, B. M. Packtor, Rubin Raskin*, Phillip Taylor*.

Phinney, B. V., Resident Engr., Commonwealth of Mass., Newton Center. References: S. T. N. Foulds, W. H. Shipp, C. R. Swaney, F. C. William.

Michigan

△Fleischer, G. A., Engr., Carrier Corp., Detroit, References: W. A. Brown, E. DeCenzo*, J. B. Olivieri, A. Petronis.

Mississippi

Waldrop, J. P., Engr., Reilly-Benton Co., Inc., Florence. References: W. M. Hamilton, W. H. Lambeth, T. D. Luke, Jr., B. L. Palmer.

Nebraska

△Anderson, R. D., Owner, Anderson Bros. Engineering Co., Omaha. References: C. A. Carter, C. A. Goth, L. N. Hunter, M. F. Stober.

New Jersey

△Bengle, C. V., Mgr., Worthington Corp., Harrison. References: L. T. Avery, E. C. Horn, H. K. Jennings, F. B. Lienhart.

Loumos, W. A., Supvr., The Austin Co., Rosell. References: J. N. Beckley*, L. V. Hoff*, G. W. Misson*, E. C. Shepard.

New Mexico

Davis, C. G., Engr. & Repr., Technical Service Co., Albuquerque. References: M. F. Fifield*, W. L. Jones, H. F. Munn, J. H. Van Alsburg.

Kryfko, E. T., Associate, Bridgers & Paxton, Albuquerque. References: R. W. Haines, J. K. James, W. L. Jones, S. H. Givelber.

Meyer, L. E., Owner, L. E. Meyer Co., Santa Fe. References: Charles Barnhard*, J. K. James, George Seebree*, P. A. Van Woerkom.

Page, L. P., Jr., Area Supervisor, University of California, Los Alamos. References: William McCall*, R. G. Merryman, R. J. Walker, C. R. Wherritt.

Sladky, J. F., Sales Engr., Automotive Equipment Co., Albuquerque. References: W. L. Beale, Marcello Giomi, J. K. James, W. L. Jones.

New York

△Bush, R. J., Head, Mech. Dept., Abbott, Merkt & Co., New York. References: Albert Giannini, Ernst Graber, W. T. Kane, R. H. Leveridge.

Crawford, C. I., Engr., Oliver & McClellan, Inc., New York. References: C. A. Hathaway, T. J. Oliver, W. F. Raymer, Jr., D. B. Robinson.

Lord, William, Mgr., General Controls Co., Buffalo. References: W. H. Hamond, J. A. Ray, R. I. Warnecke, F. Weldon*.

Sawch, Stephen, Jr. Engr., Columbia Ventilating Co., Inc., Long Island City. References: J. Danko*, T. V. D. Eppes*, J. Hartman*, M. Stuart*.

Scott, E. A., Jr., Vice Pres., Edwin A. Scott Publishing Corp., Tarrytown. References: George Boeddener, C. H. Burkhardt, R. A. Gonzalez, C. W. Nessell.

North Carolina

Lee, J. M., Jr., Mgr., Stahl-Rider-Durham, Inc., Durham. References: L. R. Gorrell, S. T. Oliver, J. M. Pleasants, W. M. Wallace II.

Moore, Ralph, Charlotte Br. Mgr., General Controls Co., Charlotte. References: L. B. Close*, W. I. Coddington*, Charles Eskridge*, John Hopping, Jr.*

Ohio

Alley, R. L., Chief Engr., American Warming & Vent. Co., Toledo. References: Fred Edgington, Jack Evans*, J. F. Guest, F. C. Richardson, Jr.

Blackmon, J. G., Repr., Chrysler Corp., Airtemp Div., Dayton. References: M. R. Durlach, Jr., F. B. Herty, W. E. Kerr, K. W. Leland.

> *Attention!!*
> *Members of ASHVE*
> *Moved or Moving?*
>
> *Each month mail is returned BECAUSE you overlooked advising us of the change in your address.*
>
> *The return mail is a loss to you, and an added expense to the Society.*
>
> *In your own interest, will you please advise us at once of any change in your business or home address, indicating which is your mailing address.*
>
> *ASHVE Headquarters*
> *62 Worth St.*
> *New York 13, N. Y.*

Grabe, E. D., Research Engr., The National Radiator Co., Johnstown. References: C. M. Baumgardner, J. W. Hall, L. N. Hunter, K. O. Schlentner.

Stevens, B. M., Appl. Engr., Reliable Plumbing & Heating Co., Marion. References: A. D. Bogen, J. A. Guy, W. A. Schoonover, R. A. Wilson.

Oklahoma

△Ellis, R. R., Engr., Colling & Gould, Cons. Engrs., Oklahoma City. References: W. J. Collins, Jr., F. R. Denham, G. E. Ervin, W. W. Frankfurt.

Pennsylvania

Lindsay, J. E., Asst. Mgr., The National Radiator Co., Johnstown. References: C. M. Baumgardner, G. M. Comstock, L. N. Hunter, K. O. Schlentner.

Spangler, E. S., Research Engr., The National Radiator Co., Johnstown. References: M. H. Hofmeister, L. N. Hunter, M. W. McRae, K. O. Schlentner.

Tanner, Edward R., Eastern Dist. Mgr., United States Air Conditioning Corp., Philadelphia. References: R. B. Davis*, Alan Dombro, W. W. Malloy, W. C. McMichael.

Tanner, Richard I., Eastern Dist. Sales Mgr., United States Air Conditioning Corp., Philadelphia. References: R. B. Davis*, Alan Dombro, W. W. Malloy, Thomas Shotton, Jr.*.

Tennessee

△Humphrey, T. O. S., Jr., Engr., Flinn, Fletcher, Humphrey, Inc., Memphis. References: W. L. Drake, G. S. Flinn, J. D. Flinn, R. E. Larkin.

Texas

Hart, J. H., Draftsman, Dale S. Cooper & Associates, Houston. References: R. E. Chrone, D. S. Cooper, P. C. Nail, E. R. Thomas.

△Hornor, L. H., Jr., Vice Pres., L. S. Pawkett & Co., San Antonio. References: R. W. Kotzebue, D. E. Locher, L. S. Pawkett, G. R. Rhine.

Washington

Clarkson, Ralph, Dept. Mgr., Brown-Johnston Co., Spokane. References: H. A. Bickel, J. A. Doyle, J. R. Morris, K. M. Wood.

Fox, S. M., Co-Owner, Stoker Lad Co., Tacoma. References: H. A. Briggs*, E. L. Mills*, D. E. Murphy*, C. E. Walters*.

Laue, G. C., Owner, Spokane Plumbing & Heating Co., Spokane. References: P. R. Inman, J. R. Morris, T. P. Nau, K. M. Wood.

O'Connell, T. E., Asst. Secy., James Smyth Plumbing & Heating Co., Spokane. References: H. A. Bickel, G. M. Dieter, J. A. Doyle, F. W. Jenkinson.

Ratzlaff, J. G., Mgr., Fiberglas Engineering & Supply Co., Spokane. References: K. J. Barnett, R. B. Campbell, L. D. Daniels, J. A. Doyle.

Roberts, T. S., Owner, Dick Roberts Plumbing & Heating, Spokane, References: Charles Devine*, P. R. Inman, George Laue, K. M. Wood.

†Succop, H. J., Jr., Sales Engr., Frederick Co., Air Filter Div., Spokane. References: R. B. Campbell, J. A. Doyle, George Dieter, K. M. Wood.

Teneff, Hobart, Partner, General Equipment Co., Spokane. References: J. L. Harvey, L. E. Marque, J. R. Morris, K. M. Wood.

Thornton, R. G., Owner, R. G. Thornton & Assocs., Spokane, References: D. E. Arnold, H. A. Bickel, F. W. Jenkinson, J. R. Morris.

Canada

△Brasloff, R. I., Partner, Mendel, Brasloff, Lassman and Sidler, Cons. Engrs., Montreal, Que. References: H. B. Cooper, R. L. Douglas, F. J. Friedman, W. E. Jarvis.

Craig, Robert, Mech. Engr., Charles Warnock & Co., Ltd., Montreal, Que. References: G. G. Monteath*, A. G. Orr, W. J. Robinson, A. D. Scothorn*.

Ilson, E. L., Cons. Engr., Montreal, Que., References: S. S. Colle, F. J. Friedman, J. A. Kearns, H. H. Schwartz*.

Leslie, A. R., Engrg. Estimator, Canadian Comstock Co., Ltd., Hamilton, Ont. References: R. H. Fitzsimmons, Rowland North, D. A. Price, Louis Sentesy.

Leydon, F. T., Asst. Project Coordinator, Directorate of Works, Dept. of National Defense, Ottawa, Ont. References: A. G. Orr, A. L. Pierce*, C. Stockman*, C. W. Watson.

Mullett, W. A., Secy., Industrial Sheet Metal Works, Ltd., Vancouver, B. C.

References: R. M. Anderson, D. M. Drake, R. W. Hole, D. W. Thomson.

Roscoe, Jack, Asst. Chief Engr., T. Eaton Co. of Canada, Ltd., Vancouver, B. C. References: D. A. English, S. B. Evans, G. K. Hale, R. D. Hale.

Schock, R. E., Sales Engr., Canadian Blower & Forge Co., Ltd., Toronto, Ont. References: D. L. Angus, M. C. Bailey, A. M. Clark, D. P. Giffin.

Argentina

Aidelman, Gabriel, Head Engr., TECAF Air Conditioning, Heating & Ventilating Co. Buenos Aires. References: Eduardo Giron, G. T. Lang, Federico Michel*, Andre Missenard.

Australia

Martin, J. B., Dir., Alfred Martin & Son, Ltd., Adelaide. References: A. E. Atherton, Louis Laybourne-Smith*, C. W. Martin*, F. P. O'Conner.

Students

GEORGIA INSTITUTE OF TECHNOLOGY, Atlanta, Ga. Certified By: O. D. Holland.

Logan, E. L.

D. E. Feinberg Promoted

D. E. Feinberg, formerly vice president, has been elected president of United States Air Conditioning Corp., Minneapolis, Minn. A member of ASHVE and a resident of St. Paul, Mr. Feinberg was graduated from the University of Minnesota with an M. E. degree and has been an officer and director of the corporation for several years.

OBITUARIES

JOSEPH H. VOLK
Milwaukee, Wis.

The Society regrets to announce the death of one of its members, Joseph H. Volk, who succumbed on July 4.

Mr. Volk was born in Milwaukee, Wis. on June 14, 1892. He joined the Thomas E. Hoye Heating Co. in 1908, and was with that firm until the time of his death. Specializing in heating, ventilating and power design and construction, he served in various capacities, culminating in the presidency. He worked as consulting heating engineer on the construction of the Arena in Milwaukee, the Parklawn housing development and a number of school buildings in that area.

A member of ASHVE since 1923, Mr. Volk served as president of the Wisconsin Chapter. He was also a member of the *Heating and Piping Contractors' Association*, the *National Association of Power Engineers* and the *National Society of Professional Engineers*.

Mr. Volk is survived by his wife, Hilda, and a son, George H., vice-president of the Thomas E. Hoye Heating Co. and an ASHVE member. The Officers and Council of the Society extend their deepest sympathy to Mrs. Volk and her son.

FREDERICK L. RICKMEYER
Euclid, Ohio

Frederick L. Rickmeyer died of coronary thrombosis at his home in Euclid, Ohio on July 17, at the age of 43. The Society was sorry to learn of the death of Mr. Rickmeyer, who became an ASHVE member in 1952 and was affiliated first with the New York and later with the Northern Ohio Chapter.

For the past two years, Mr. Rickmeyer was chief engineer of the Ventilation Division, The Swartwout Co., Cleveland, Ohio. From 1950-52 he was district sales manager of the Ventilation Division in the Swartwout New York District. He was previously employed by Gibbs & Cox and the M. W. Kellogg Co. of New York as a ventilation engineer.

The Society, through the Officers and Council, offers sincere sympathy to his family.

THE AMERICAN SOCIETY

Headquarters:
62 Worth St.
New York 13, N. Y.

Research Laboratory:
7218 Euclid Ave.,
Cleveland 3, Ohio

OFFICERS

President.......L. N. Hunter
First Vice President.......John E. Haines
Second Vice President.......John W. James
Treasurer.......E. R. Queer
Executive Secretary.......A. V. Hutchinson

•

Technical Secretary.......Carl H. Flink
Assistant Secretary.......David T. Donovan
Editor.......C. H. B. Hotchkiss
Public Relations.......W. M. Vidulich

COUNCIL

L. N. Hunter, Chairman; John E. Haines, Vice Chairman.

Three Years: John H. Fox, Arthur J. Hess, C. H. Pesterfield, Benjamin H. Spurlock, Jr.

Two Years: I. W. Cotton, A. W. Edwards, L. T. Mart; B. W. Farnes (one year).

One Year: M. K. Fahnestock, P. B. Gordon, R. T. Kern, D. M. Mills, Reg. F. Taylor.

ADVISORY BOARD

Reg. F. Taylor, Chairman; Lester T. Avery, M. F. Blankin, S. E. Dibble, S. H. Downs, E. O. Eastwood, W. L. Fleisher, H. P. Gant, H. M. Hart, C. V. Haynes, D. D. Kimball, S. R. Lewis, A. J. Offner, F. B. Rowley, L. E. Seeley, A. E. Stacey, Jr., Ernest Szekely, G. L. Tuve, A. C. Willard, C.-E. A. Winslow and B. M. Woods.

COUNCIL COMMITTEES

Executive: John E. Haines; Chairman; John W. James, E. R. Queer.

Subcommittee on Operational Guides: H. E. Sproull, Chairman; E. L. Crosby, G. W. F. Myers.

Finance: John W. James, Chairman; A. J. Hess, L. T. Mart, E. R. Queer, Ex-Officio.

Ways and Means: J. C. Fitts, Chairman; John Everetts, Jr., P. B. Gordon, C. A. McKeeman, E. R. Queer.

Membership: D. M. Mills, Chairman; I. W. Cotton, J. H. Fox.

Program and Papers: B. H. Spurlock, Jr., Chairman; R. T. Kern, C. H. Pesterfield.

GENERAL COMMITTEES

Admission and Advancement: Carl F. Boester, Chairman (one year); Roswell Farnham (two years); C. S. Koehler (three years).

Publication: Linn Helander, Chairman (one year); Axel Marin (two years); G. B. Priester (three years).

Guide: R. E. Cherne, Chairman; P. R. Achenbach, A. B. Newton (one year); A. L. Hesselschwerdt, A. A. Marks, W. M. Wallace, II (two years); Albert Giannini, A. T. Jones, J. F. Sandfort (three years); R. S. Dill, Ex-Officio.

Charter and By-Laws: G. D. Winans, Chairman (one year); M. W. Bishop (two years); A. E. Stacey, Jr. (three years).

F. Paul Anderson: John E. Haines, Chairman; Lester T. Avery, S. R. Lewis, L. E. Seeley, B. M. Woods.

Chapter Relations: Reg. F. Taylor, Chairman; G. W. Bornquist, E. L. Crosby, B. L. Evans, N. W. Kingsland, W. B. Morrison, C. W. Stone.

Chapters Conference: W. J. Collins, Jr., Chairman; J. S. Burke, Vice Chairman; J. E. Schechter, Secretary. Members and Alternate Members selected by local chapters are respectively:

ARIZONA: A. C. Baechlin, Jr.—W. A. Biddle
ARKANSAS: J. L. Brown—W. J. Franklin
ATLANTA: J. M. Lazenby—T. A. Barrow, Jr.
BALTIMORE: H. D. Glaser—E. H. Taze
BR. COLUMBIA: C. W. Leek—S. C. Gale
CENTRAL N. Y.: C. R. Acheson
CENTRAL OHIO: N. T. Hess—J. A. Guy
CINCINNATI: H. E. Russell—F. W. Wilson
CONNECTICUT: Walter Heywood—C. L. L'Hommedieu
DELTA: J. S. Burke—Walter Cooke
EMP. ST. CAPITAL: D. A. Carofano—G. G. Davis
GOLDEN GATE: R. D. Knowles—H. A. Wolfson

OF HEATING AND VENTILATING ENGINEERS

Chapters Conference (Continued)
ILLINOIS: H. G. Chapin—G. V. Zintel
INDIANA: J. T. Hardin—R. C. Blackman
INLAND EMPIRE: H. A. Bickel—F. W. Jenkinson
IOWA: R. S. Stover—J. F. Sandfort
KANSAS: Charles Yoe—O. P. Bullock
KANSAS CITY: F. K. Ladewig—A. S. Hurt, Jr.
MANITOBA: J. A. Bell—H. F. Randall
MASSACHUSETTS: A. L. Hare—G. W. Sprague
MEMPHIS: M. H. Ellis, Jr.—E. A. Smith
MIAMI VALLEY: J. M. Schweiger—R. W. Kimmel
MICHIGAN: R. H. Oberschulte—E. F. Glanz
MINNESOTA: V. E. Pearson—J. A. Craig
MISSISSIPPI: Burt Lomax, Jr.—W. C. Piatt
MONTREAL: B. J. Horsburgh—D. L. Lindsay
NEBRASKA: H. H. Ulrich—C. A. Failor
NEW YORK: J. E. Schechter—R. L. Stinard
NORTH JERSEY: F. H. Faust—C. H. Smith
NO. TEXAS: J. A. Ray—G. H. Meffert
N.E. OKLA.: R. F. Shoemaker—C. H. Dollmeyer
NORTHERN OHIO: D. E. Mannen, Jr.—L. C. Burkes
NO. PIEDMONT: R. B. Crosland, Jr.—S. T. Oliver
OKLAHOMA: W. J. Collins, Jr.—F. R. Denham
ONTARIO: H. R. Roth—M. C. Bailey
OREGON: E. E. Kelly—E. R. Lokey
OTTAWA VALLEY: W. J. Robinson—W. B. Pennock
PAC. NO. WEST: T. C. Caskey—W. J. Olson
PHILADELPHIA: M. E. Barnard—P. H. Yeomans
PITTSBURGH: E. C. Hach—J. W. Frazier
SACRAMENTO VALLEY: E. C. McKinsey—J. E. Marshall
ST. LOUIS: H. C. Sharp—E. T. Clucas
SHREVEPORT: J. S. Malahy, Jr.—R. S. Segall
SOUTH TEXAS: J. W. Holland—J. C. Lewis
SO. CALIF.: L. B. Davenport—J. R. Hall
SO. PIEDMONT: R. S. Fullerton
SO. W. TEXAS: F. B. Frazee—Boone Crisp
UTAH: E. V. Gritton
VIRGINIA: D. C. Delinger—J. E. White
WASHINGTON, D. C.: J. G. Muirheid—P. R. Achenbach
WEST TEXAS: L. C. McKay—R. A. Mixon
W. MICH.: F. W. Brundage—J. T. Anderson
WESTERN N. Y.: C. W. Stone—Roswell Farnham
WISCONSIN: H. F. Brinen—J. A. Lofte

Committee on Research: R. S. Dill, Chairman; B. H. Jennings, Vice Chairman, E. R. Kaiser, Director of Research.

Three Years: John Everetts, Jr., W. F. Friend, Carl F. Kayan, H. R. Limbacher, E. F. Snyder, Jr.

Two Years: R. S. Dill, F. H. Faust, F. K. Hick, M.D., H. A. Lockhart, J. W. McElgin.

One Year: I. W. Cotton, W. A. Grant, N. B. Hutcheon, B. H. Jennings, C. O. Mackey.

Executive Committee: R. S. Dill, Chairman; B. H. Jennings, Vice Chairman; John Everetts, Jr., F. H. Faust, C. O. Mackey.

Long-Range Research Program: B. H. Jennings, Chairman; John Everetts, Jr., F. H. Faust, John W. James, C. O. Mackey, R. S. Dill, Ex-Officio.

Technical Advisory Committees—1954

Air Cleaning: A. B. Algren, Chairman; E. F. Snyder, Jr.*, Vice Chairman; B. L. Evans, R. S. Farr, C. D. Graham, A. J. Hess, A. B. Hubbard, G. F. Landgraf, Arthur Nutting, H. E. Robinson, J. R. Swanton, Jr., W. T. Van Orman.

Air Distribution: W. O. Huebner, Chairman; W. A. Grant*, Vice Chairman; J. M. Black, H. F. Brinen, R. M. Conner, S. H. Downs, Nathan Feder, S. F. Gilman, Linn Helander, F. B. Holgate, W. W. Kennedy, E. J. Kurek, J. N. Livermore, G. E. McElroy, R. D. Madison, L. G. Miller, H. B. Nottage, L. R. Phillips, G. B. Priester, C. H. Randolph, G. L. Tuve.

Combustion: T. H. Smoot, Chairman; H. R. Limbacher*, Vice Chairman; P. R. Achenbach, R. B. Engdahl, H. G. Hays, R. C. Johnson, W. B. Kirk, D. W. Locklin, A. A. Marks, W. M. Myler, Jr., E. A. Norman, Jr., E. O. Olson, K. O. Schlentner, R. K. Thulman, E. C. Webb, D. L. Wooden.

Cooling Load: C. O. Mackey*, Chairman; R. C. Jordan, Vice Chairman; K. O. Alexander, John Everetts, Jr.*, H. T. Gilkey, R. H. Heilman, H. W. Heisterkamp, A. J. Hess, A. T. Jorn, C. F. Kayan*, J. N. Livermore, P. E. McNall, Jr., I. A. Naman, H. B. Nottage, C. P. Roberts, J. P. Stewart, H. B. Vincent, T. N. Willcox, W. E. Zieber.

Evaporative Cooling: A. J. Hess, Chairman; C. F. Kayan*, Vice Chairman; R. S. Ash, H. E. Degler, S. F. Duncan, H. S. Dutcher, John Engalitcheff, Jr., Stuart Giles, E. V. Gritton, Leo Hungerford, R. C. Jordan, L. C. Pellegrini, C. B. Rowe, R. J. Salinger, Edward Simons, W. T. Smith, B. H. Spurlock, Jr., J. R. Watt, D. D. Wile.

Heat Flow Through Glass: R. A. Miller, Chairman; N. B. Hutcheon*, Vice Chairman; W. J. Arner, F. L. Bishop, E. W. Conover, D. D'Eustachio, W. B. Ewing, J. E. Frazier, J. S. Herbert, R. W. McKinley, E. C. Miles, H. B. Vincent, C. J. Youngblood, Jr.

Heat Pump: E. P. Palmatier, Chairman; F. H. Faust*, Vice Chairman; E. R. Ambrose, F. R. Ellenberger, W. F. Friend*, S. F. Graziano, G. C. Hall, R. C. Jordan, C. F. Kayan*, J. D. Kroeker, F. R. O'Brien, J. R. Swanton, Jr.

Heating Load: P. R. Achenbach, Chairman; W. F. Friend*, Vice Chairman; A. I. Brown, C. O. Christenson, H. T. Gilkey, W. S. Harris, N. B. Hutcheon*, Fred McGhan, T. F. Rockwell, S. I. Rottmayer, C. W. Signor.

Hot Water and Steam Heating: John W. James, Chairman; H. A. Lockhart*, Vice Chairman; R. C. Chewning, H. C. Day, W. S. Harris, L. N. Hunter, A. T. Jones, M. W. McRae, N. D. Skinner, S. K. Smith, Benjamin Spieth, M. H. Westerberg.

Human Calorimetry: G. L. Tuve, Chairman; I. W. Cotton*, Vice Chairman; Nathaniel Glickman, J. D. Hardy, E. R. Queer, L. E. Seeley, T. H. Urdahl, C. P. Yaglou.

Industrial Environment: P. J. Marschall, Chairman; J. W. McElgin*, Vice Chairman; J. L. Alden, A. D. Brandt, F. H. Buzzard, F. N. Calhoon, K. J. Caplan, J. H. Clarke, R. B. Foley, T. F. Hatch, W. C. L. Hemeon, W. O. Huebner, J. M. Kane, M. G. Kershaw, G. E. Klapper, G. E. McElroy, K. E. Robinson, Leslie Silverman, B. R. Small, R. P. Warren, W. N. Witheridge, H. E. Ziel.

Insulation: M. W. Keyes, Chairman; N. B. Hutcheon*, Vice Chairman; L. A. Barron, C. B. Bradley, P. D. Close, R. B. Crepps, E. T. Erickson, G. A. Erickson, M. L. Erickson, R. H. Heilman, F. A. Joy, W. A. Knudson, H. E. Lewis, W. J. Marshall, V. L. Miller, F. E. Parsons, E. L. Perrine, K. M. Ritchie, H. E. Robinson, L. V. Teesdale, R. K. Thulman.

Odors: T. H. Urdahl, Chairman; C. F. Kayan*, Vice Chairman; L. H. Beck, N. E. Berry, V. G. Dethier, A. H. Gee, A. B. Hubbard, B. H. Jennings*, G. W. Meek, J. A. Ross, Sherman Ross, R. G. H. Siu, Amos Turk, W. N. Witheridge.

Panel Heating and Cooling: P. B. Gordon, Chairman; C. O. Mackey*, Vice Chairman; A. B. Algren, John Everetts, Jr.*, L. N. Hunter, R. L. Maher, S. K. Smith, E. F. Snyder, Jr.*, J. M. van Nieukerken.

- Group A—Heat and Distribution Within and Behind the Panel: R. L. Maher, Chairman, H. L. Flodin, G. D. Lain, L. J. LaTart, V. L. Miller, C. W. Nessell, S. I. Rottmayer, R. T. Schoerner, O. H. Storey, Jr., R. K. Thulman.
- Group B—Heat Transfer Between the Panel and the Space: J. M. van Nieukerken, Chairman; C. O. Mackey*, Vice Chairman; C. M. Ashley, W. P. Chapman, W. S. Harris, Linn Helander, E. S. Howarth, A. T. Jorn, C. F. Kayan*, L. J. LaTart, H. A. Lockhart*, W. E. Long, R. L. Maher, R. A. Miller, G. L. Wiggs.
- Group D—Controls: E. F. Snyder, Jr.*, Chairman; A. B. Algren, H. W. Alyea, Louis Barfus, S. D. Browne, O. P. Bullock, J. A. Deubel, C. A. Gustafson, W. J. Hajek, W. H. Kliever, H. T. Kucera, J. S. Locke, J. F. McCauley, J. F. Page, L. C. Plaehn, J. K. M. Pryke, A. O. Roche, Jr., C. W. Signor.

Physiological Research: M. K. Fahnestock, Chairman; R. W. Keeton*, M.D., Vice Chairman; Lester T. Avery, Thomas Bedford, H. S. Belding, William Bruce, A. C. Burton, A. P. Gagge, Nathaniel Glickman, F. K. Hick, M.D., John W. James, R. D. Madison, P. J. Marschall, Sid Robinson, C. L. Taylor, T. L. Willmon, M.D., C.-E. A. Winslow.

Plant and Animal Husbandry: A. J. Hess, Chairman; H. A. Lockhart*, Vice Chairman; A. B. Algren, H. A. Borthwick, Samuel Brody, John Everetts, Jr*, F. G. Gustafson, S. R. Lewis, H. H. Mitchell, K. V. Thimann, W. G. Whaley, R. B. Withrow, H. E. Ziel.

Sensations of Comfort: C. S. Leopold, Chairman; E. F. Snyder, Jr.*, Vice Chairman; Lester T. Avery, John Everetts, Jr.*, M. K. Fahnestock, Nathaniel Glickman, A. J. Hess.

Sorption: G. L. Simpson, Chairman; John Everetts, Jr.*, Vice Chairman; G. C. F. Asker, O. D. Colvin, F. C. Dehler, W. E. Emley, Jr., A. S. Gates, Jr., E. W. Gifford, E. R. McLaughlin.

Sound and Vibration Control: H. A. Lockhart*, Chairman; C. M. Ashley, A. E. DeSomma, Sidney Gordon, W. F. Hagen, H. C. Hardy, E. M. Herrmann, C. R. Hiers, F. B. Holgate, A. F. Hubbard, G. C. Kerr, R. D. Madison, W. L. Rogers, T. A. Walters.

Weather Data: John Everetts, Jr.*, Chairman, P. R. Achenbach, I. W. Cotton, H. E. Degler, J. B. Graham, L. L. Hamig, S. A. Heider, W. L. Holladay, C. O. Mackey*, H. C. S. Thom, M. K. Thomas.

●

Public Relations: A. W. Edwards, Chairman; M. K. Fahnestock, T. V. Johnson, R. E. Moore.

Standards: P. B. Gordon, Chairman; F. H. Faust (three years); R. S. Dill, J. C. Fitts, (two years); K. T. Davis, S. H. Downs (one year).

ASHVE Committee on Code for Testing and Rating Heavy Duty Furnaces: E. K. Campbell, Chairman; Bowen Campbell, R. S. Dill, A. P. Loeb, C. J. Low, W. J. MaGirl, B. F. McLouth, F. L. Meyer, L. G. Miller, A. A. Olson, H. A. Pietsch, O. J. Ress, H. A. Soper.

ASHVE Committee on Safety Regulations for Heating, Ventilating and Air Conditioning Systems: G. P. Nachman, Chairman; F. H. Buzzard, H. W. McKenzie, B. F. McLouth, C. H. Randolph.

Joint Committee on Standards for Comfort Air Conditioning: W. L. Fleisher, Chairman; (ASHVE) O. W. Armspach, A. C. Buensod, C. C. Cheyney; (ASME) C. F. Kayan; (ASRE) F. H. Faust, C. F. Holske, J. A. Schurman; (ARI) M. M. Lawler, R. A. Gonzalez; Alternate: J. R. Schreiner; (U.S. Public Health Service) W. C. Cooper, M.D.; At Large: M. K. Fahnestock, P. J. Marschall, G. E. May, A. B. Newton; (Medical Profession) R. W. Keeton, M.D., W. J. McConnell, M.D.

SPECIAL COMMITTEES

Awards: Linn Helander, Chairman; M. F. Blankin, G. L. Tuve

ASHVE-ASRE Joint Committee: F. H. Faust, Chairman; E. N. McDonnell, Vice Chairman; M. C. Turpin, Secretary. ASHVE Representatives: M. F. Blankin, P. B. Gordon, J. E. Haines, E. N. McDonnell, E. R. Queer. ASRE Representatives: F. H. Faust, C. F. Kayan, James Larkin, J. F. Stone, N. N. Wolpert.

Building: A. J. Offner, Chairman; Albert Buenger, P. B. Gordon, L. E. Seeley, T. H. Urdahl.

Engineers' Joint Council: L. E. Seeley (ASHVE Representative).

Exposition Rates: E. N. McDonnell, Chairman; S. H. Downs, John E. Haines.

International Joint Committee on Psychrometric Data: C. O. Mackey, Ithaca, N. Y., Chairman; B. A. Dmitrieff, New York, N. Y., Secretary; H. H. Bruce, London; G. A. Bull, London; C. S. Cragoe, Washington, D. C.; John A. Goff, Philadelphia; L. P. Harrison, Washington, D. C.; T. J. G. Henry, Toronto; B. H. Jennings, Evanston, Ill.; F. G. Keyes, Cambridge, Mass.; R. F. Legget, Ottawa; S. G. Rison, Washington, D. C.; P. A. Sheppard, London; J. L. York, Ann Arbor, Mich.

Long-Range Planning Committee: J. E. Haines, Chairman; P. B. Gordon, A. J. Hess, John W. James, J. D. Kroeker, L. E. Seeley.

NRC-National Academy of Sciences, Div. of Engrg.: B. H. Jennings.

To Codify Council Policies: J. H. Fox, Chairman; I. W. Cotton, A. W. Edwards, B. H. Spurlock, Jr.

●

Nominating: M. S. Wunderlich, Minneapolis, Chairman; John Bonner, Cambridge, Mass., Vice Chairman; A. O. Roche, Indianapolis, Secretary; J. F. Collins, Jr., Pittsburgh; G. T. Donceel, Oklahoma City; Fred Janssen, Denver; R. L. Kent, Winnipeg, Man.; G. A. Linskie, Dallas; H. G. S. Murray, Montreal, Que.; H. E. Russell, Middletown, Ohio; W. O. Stewart, Los Angeles. Alternate: T. C. Caskey, Seattle.

---

*Member of Committee on Research.

ASHVE — OFFICERS OF CHAPTERS AND BRANCHES

(57 Chapters; 1 Special Branch; 8 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

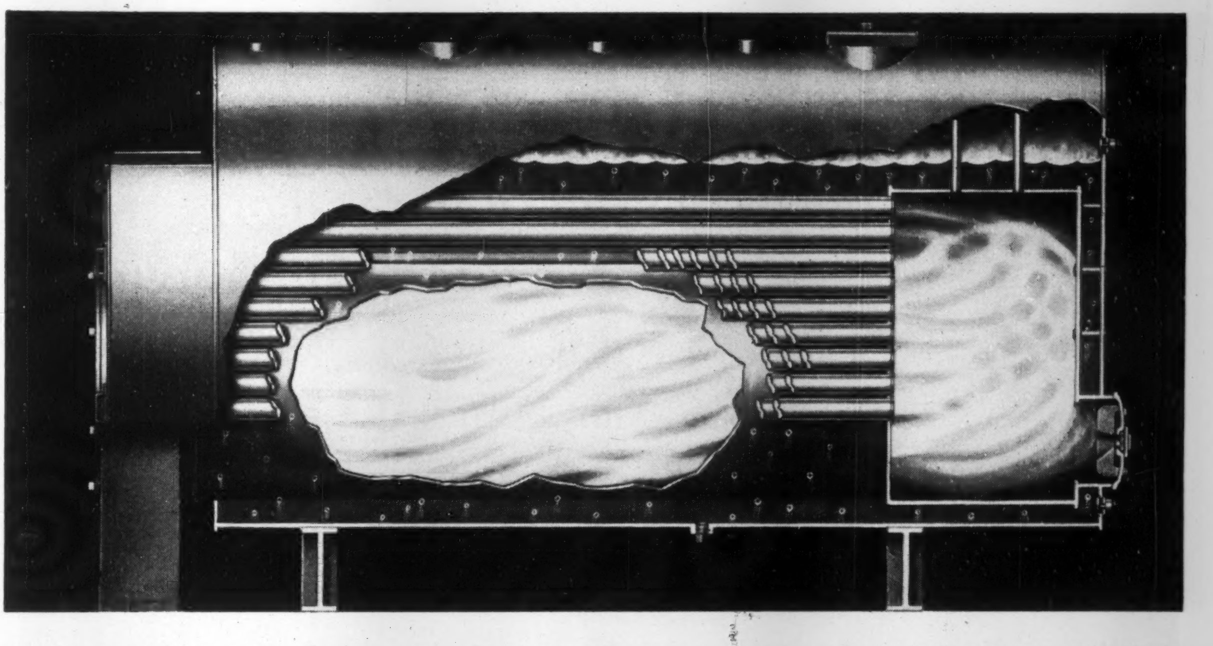
- **ARIZONA:** 1953. Hdqrs., Phoenix. Meets, First Monday. PRESIDENT, V. J. Carns, 3602 No. 15th Dr. SECRETARY, A. J. Nelesen, Jr., 6744 No. 14th Pl.
- **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, Third Tuesday. PRESIDENT, R. E. Blaylock, 509 E. Markham St. SECRETARY, J. L. Brown, 212 Terminal Warehouse Bldg.
- **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, Second Monday. PRESIDENT, J. M. Lazenby, 8 11th St., N.E. SECRETARY, F. W. Bull, 1205 Spring St., N. W.
- **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, Third Wednesday. PRESIDENT, E. H. Taze, 33 E. 21st St. (18). SECRETARY, R. F. Weisman, 4650 Reisterstown Rd., (15).
- **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. Meets, Second Wednesday. PRESIDENT, S. C. Gale, 1628 W. 4th Ave. SECRETARY, D. A. English, 1606 W. 1st Ave. (9).
- **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, F. D. Putnam, 115 Pulsifer Dr., Auburn. SECRETARY, Merle Weninger, 230 Goodrich Ave. (5).
- **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT J. A. Guy, 478 W. Fifth Ave. (1). SECRETARY, W. A. Schoonover, 2901 N. High St. (2).
- **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, F. W. Wilson, 222-24 E. 14th St. SECRETARY, R. G. Anderson, 1758 Elmore St. (23).
- **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, C. L. L'Hommedieu, 76 Blatchley Ave. SECRETARY, Walter Heywood, 14 Hartt Lane, Newington.
- **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, C. V. Bankston, 2927 Jackson Ave. (25). SECRETARY, W. B. Martin, Jr., 2014 Rendon St. (15).
- **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. Meets, Second Wednesday. PRESIDENT, E. C. Doyle, 315 Washington Ave. SECRETARY, H. F. Kruger, 501 Seventh Ave., Troy.
- **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, First Thursday. PRESIDENT, Eric Roberts, 417 Market St. SECRETARY, F. K. Crouch, 906 Cerrito St., Albany (6).
- **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, George V. Zintel, 840 N. Michigan Ave. (11). SECRETARY, H. G. Gragg, 228 N. LaSalle St. (1).
- **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, P. O. Patterson, 2701 Roosevelt Ave. SECRETARY, A. O. Roche, Jr., 3950 Broadway (5).
- **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, H. A. Bickel, E. 7 Riverside Ave. SECRETARY, Max Tonn, S. 4021 Latawah St.
- **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, W. E. Nanes, 220 Davidson Bldg. SECRETARY, D. E. Schroeder, 2717 Cambridge.
- **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tuesday after First Monday. PRESIDENT, Charles Yoe, P.O. Box 2239. SECRETARY, T. L. Roberts, 2008 S. Parkwood Lane.
- **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, F. K. Ladewig, 3527 Broadway (11). SECRETARY, R. M. Spencer, 1510 Main St. (8).
- **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Fourth Thursday. PRESIDENT, G. T. Christie, Midland & Notre Dame. SECRETARY, A. J. McIntyre, 935 Garwood Ave.
- **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, G. W. Sprague, 108 Cummington St. SECRETARY, W. G. Burbo, 137 Newbury St. (16).
- **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, A. W. Shelby, 972 Union Ave. SECRETARY, A. T. Bevil, 1638 Union Ave. (4).
- **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT John Schweiger, 593 Acorn Drive, (9). SECRETARY, D. E. Tullis, 743 Kiser St. (4).
- **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, E. F. Glanz, 1761 W. Forest Ave. (8). SECRETARY, J. H. Spitzley, 1200 Fort St., W. (26).
- **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, J. A. Craig, 814 South Ninth St. (4). SECRETARY, E. T. Erickson, 500 Baker Arcade (2).
- **MISSISSIPPI:** 1953. Hdqrs., Jackson, Miss. PRESIDENT, I. E. Rowe, 120 Georgia St. SECRETARY, M. E. Price, 205 Arbor Hill Dr.
- **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, D. L. Lindsay, 4350 Sherbrooke St. (6). SECRETARY, S. R. Plamondon, 2267 Melrose Ave. (14).
- **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, C. A. Goth, 3115 N. 49th Ave. SECRETARY, L. J. Paulsen, 1901 S. 39th St.
- **NEW MEXICO:** 1954. Hdqrs. Albuquerque, N.M. PRESIDENT, J. H. Van Alsburg, 1330 Cerro Gordo, Santa Fe. SECRETARY, J. K. James, 4462 Avenida del Sol.
- **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, R. L. Stinard, 51 E. 42nd St. (17). SECRETARY, Carl H. Flink, 62 Worth St. (13).
- **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, Second Tuesday. PRESIDENT, H. M. Patrick, 20 Olcott Ave., Bernardsville. SECRETARY, W. C. Kruse, Jr., 40 E. Park St. (2).
- **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, M. W. Brown, 1213 Texas Bank Bldg. SECRETARY, H. G. Gregerson, 2921 Fairmount.
- **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, Second Tuesday. PRESIDENT, R. W. Winget, 2428 E. 11th St., Box 100. SECRETARY, J. T. McKinney, 1341 So. Boston.
- **NORTHERN OHIO:** 1916. Hdqrs. Cleveland, Ohio. Meets, Second Monday. PRESIDENT, D. E. Mannen, 9104 Woodland Ave. (3). SECRETARY, H. R. Canoyer, 1900 Superior Ave., Bay Village.
- **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N.C. Meets, Second or Third Friday. PRESIDENT, R. B. Crosland, Jr., 1001 S. Marshall St., Winston-Salem. SECRETARY, W. H. Cooper, 1001 S. Marshall St., Winston-Salem.
- **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, G. E. Ervin, 2800 N. Oklahoma St. (5). SECRETARY, F. R. Denham, 320 Oklahoma Natural Bldg.
- **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, M. C. Bailey, 1139 Bay St. SECRETARY, H. R. Roth, 57 Bloor St., W.
- **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, E. E. Kelly, 4504 S.W. Corbett Ave. (1). SECRETARY, K. N. Flocke, 3027 N.E. 31st Ave. (12).
- **OTTAWA VALLEY:** 1952. Hdqrs., Ottawa, Ont., Canada. Meets, Third Tuesday. PRESIDENT, W. J. Robinson, 1174 Wellington St. SECRETARY, N. J. Howes, Box 264, R.R. 1.
- **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, T. C. Caskey, 11642—26th Ave., So. (88). SECRETARY, E. W. Triol, 407 Medical Arts Bldg.
- **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, L. M. Church, 12 So. 12th St. (7). SECRETARY, C. J. Forve, Parkwood Manor, Apt. B-202, State Rd. & Penarth Ave., Upper Darby.
- **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, E. C. Hach, 221 Broadmoor Ave. (34). SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).
- **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, H. L. Wray, 1101 Geneva St., Aurora. SECRETARY, J. F. Cipra, Jr., 2676 S. Madison St.
- **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. Meets, First Wednesday. PRESIDENT, J. E. Marshall, 441 Pico Way. SECRETARY, V. W. Thornburg, 2470 27th Ave.
- **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, G. H. Bemarkt, St. Clair Dr., R.R. 1, Caseyville, Ill. SECRETARY, W. P. Norris, 1118 Fullerton Bldg.
- **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, J. S. Malahy, Jr., 1839 Line Ave. SECRETARY, H. E. Scott, 2502 Woodford St.
- **SOUTH CAROLINA:** 1954. Hdqrs., Columbia, S. C. PRESIDENT, R. F. Donovan, P.O. Box 3053. SECRETARY, J. E. McMurray, 1639 Blanding St.
- **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, J. W. Holland, 245 Esperson Bldg. (2). SECRETARY, J. C. Lewis, 4101 San Jacinto St. (4).
- **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, C. D. Walz, 3600 San Pasqual St., Pasadena (10). SECRETARY, H. F. Ulovec, 3886 Olympiad Dr. (43).
- **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRESIDENT, R. S. Fullerton, P.O. Box 3697. SECRETARY, J. R. Clark, P.O. Box 1755.
- **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, L. H. Hornor, Jr., 816 Insurance Bldg. SECRETARY, Boone Crisp, P.O. Box 9065, (4).
- **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, A. A. Maycock, P.O. Box 36 (10). SECRETARY, W. L. Stuewe, 1472 S. State St.
- **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, H. E. Marquart, 111 W. Main St. SECRETARY, R. L. Burton, Jr., 1913 Lafayette Blvd.
- **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, G. C. F. Asker, 1109 W. Broad St., Falls Church, Va. SECRETARY, C. P. Humke, 5905 Berwyn Rd., Rt. 1, Box 89, College Park, Md.
- **WEST TEXAS:** 1953. Hdqrs., Lubbock, Tex. PRESIDENT, L. C. McKay, 210 Sanford Bldg. SECRETARY, J. C. Wharton, Box 1240.
- **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, F. W. Brundage, 512 N. Park St., Kalamazoo (11). SECRETARY, F. L. Murray, 482 W. Michigan Ave., Battle Creek.
- **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, Q. P. Thompson, 260 Richmond Ave. (22). SECRETARY, G. E. Kuhn, 475 Woodland Dr., Kenmore (23).
- **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, L. C. Plaehn, 914 N. Broadway (2). SECRETARY, H. W. Alyea, 507 E. Michigan St. (2).

SPECIAL BRANCH

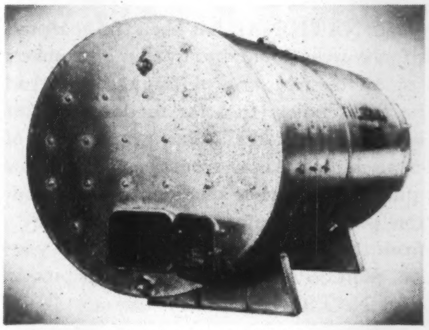
- **SWITZERLAND:** 1952. Hdqrs., Zurich. PRESIDENT: Walter Sennhauser, Sulzer Bros., Ltd., Winterthur. SECRETARY, Walter Hausler, Erbstrasse 2, Kusnacht, Zurich.

STUDENT BRANCHES

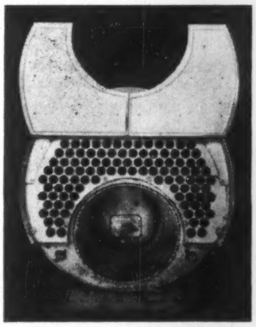
- **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Norman Falbaum, Box 4668, State College Station. SECRETARY, J. L. Flowers, Apt. 33-E, Vetville.
- **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. PRESIDENT, C. E. Durrett, 1215 College. SECRETARY, R. M. Jauch, 308½ W. Maple.
- **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. E. Bulletset, 252 Kings Rd. SECRETARY, I. P. Parkhurst, 1354 Harrison.
- **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, E. B. Katz, 415 State St. SECRETARY, R. A. Chambers, 248 Littleton.
- **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, D. F. Carroll, Box 6264. SECRETARY, C. W. Farrar, Jr., Rt. 1, Box 339, Bryan.
- **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, J. R. Cairns, 4001 Florence, (21). SECRETARY, W. E. Zimmerman, 15359 Lauder (27).
- **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday.
- **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, Alexander Tudor, 75 South Dr. SECRETARY, T. M. Devine, More House, St. Michaels College.



MORE ECONOMICAL BECAUSE IT'S COMPLETELY WATER-JACKETED



Insulated access door is provided in rear of combustion chamber for inspection and cleaning.



Lifting the front access door exposes all tubes for cleaning.

STEEL BOILER INSTITUTE
·SBI·
HEATING PROCESS POWER

SINCE 1886
MOST ECONOMICAL IN FUEL
1886
THE FITZGIBBONS BOILER
REG. U. S. PAT. OFF.

THE FITZGIBBONS BOILER®

"Scotch Type"
saves on fuel and installation

Complete water-jacketing of *all* heating surfaces in this popular Fitzgibbons low pressure boiler means savings every step of the way—from installation to actual operation of equipment.

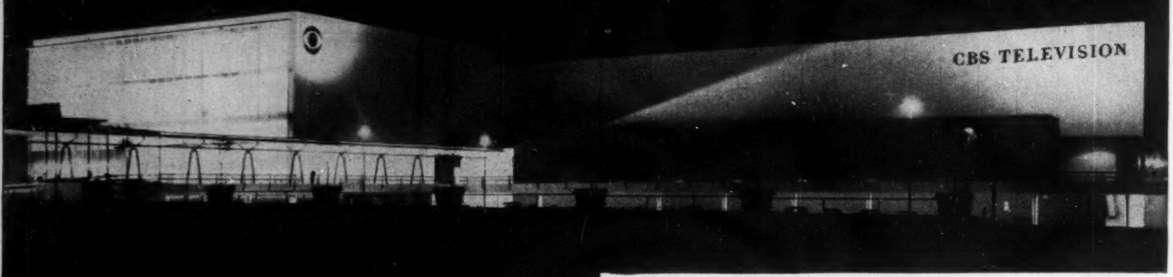
Specially important is the *water-cooled rear furnace wall.* This feature, not obtainable in many Scotch-type heating boilers, reduces flue gas temperatures, saves fuel, and eliminates the original expense of the usual rear dry-wall refractory lining and its high maintenance costs.

With a low water line, this boiler is ideal for locations where low headroom is a necessity or where excavation costs because of rock or water would be prohibitive.

For complete details, write to the Fitzgibbons Boiler Company, Inc., 101 Park Avenue, New York 17, N. Y. Ask for Catalog HP-9.

THE FITZGIBBONS BOILER®

TELEVISION CITY ... expansible nucleus for a giant of the future



"TELEVISION CITY"—CBS-TV's West Coast studios reflect the efficiency, flexibility and expansibility of their design. Architects • Engineers: Pereira & Luckman. General Contractor: William Simpson Construction Co.

● The Columbia Broadcasting System's clean-lined "Television City" in Hollywood, California is the core of an anticipated 25-acre, 24-studio expansion of the network's West Coast TV production facilities. Plans for future enlargement of the building specify that the present walls be easily demountable. Consequently, most of the exterior is composed of large, plain, movable steel panels and glass walls.

The sleek lines of the structure manifest the ideas of efficiency and flexibility upon which the design was based. With such key words as a guide to design, it is a foregone conclusion that the most efficient and dependable pipe and tubing should be chosen for the building's plumbing and heating systems. NATIONAL Steel Pipe got the nod.

For over 60 years NATIONAL has been the accepted standard pipe for conventional hot water and steam heating systems, fire control, and plumbing lines. And today, it is the first choice, too, for modern radiant heating and snow melting installations. Regardless of the application, architects know from long experience that they can put their complete confidence in the uniform, dependable performance of NATIONAL Pipe.

Take a tip from the old timers. When you plan your next installation, plan on using the best-known pipe in the world—U·S·S NATIONAL Steel Pipe.

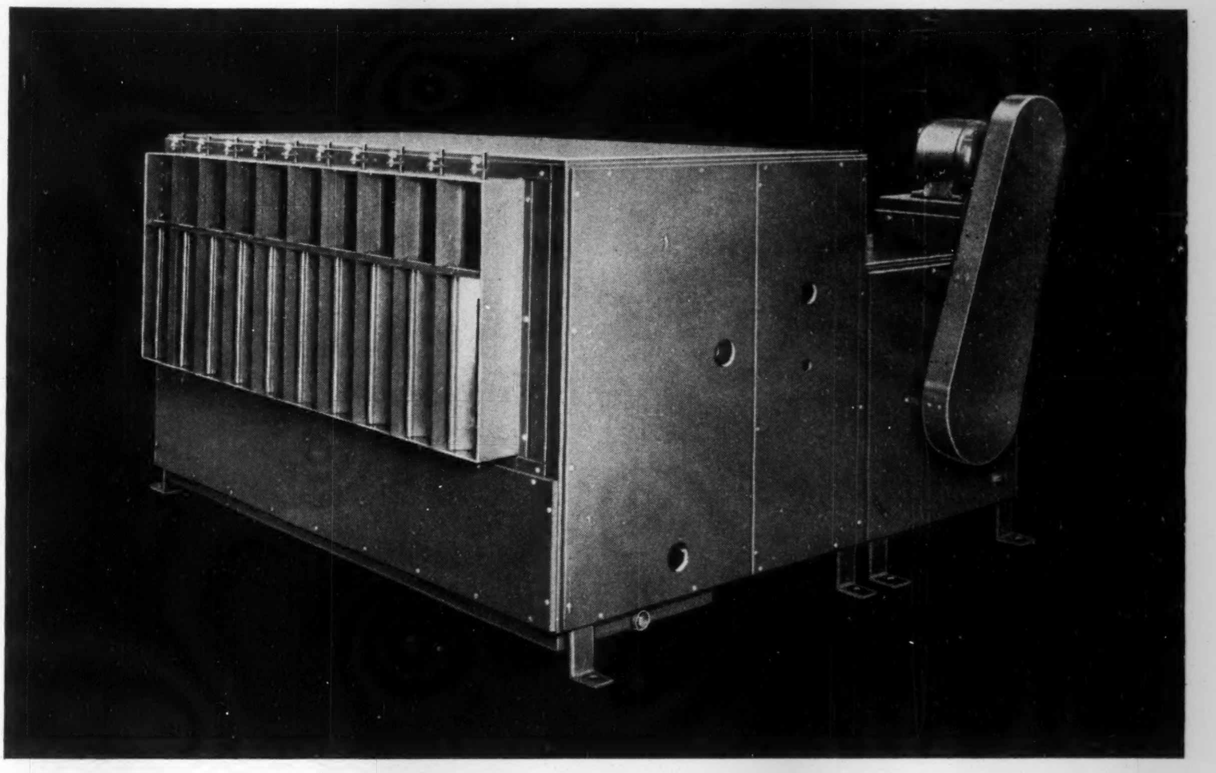
NATIONAL TUBE DIVISION,
UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

CBS TELEVISION CITY

USS

U·S·S NATIONAL Steel PIPE

UNITED STATES STEEL



Now...A Westinghouse Multi-Zone Unit Automatically Conditions Air— Up to 12 Independent Zone Areas

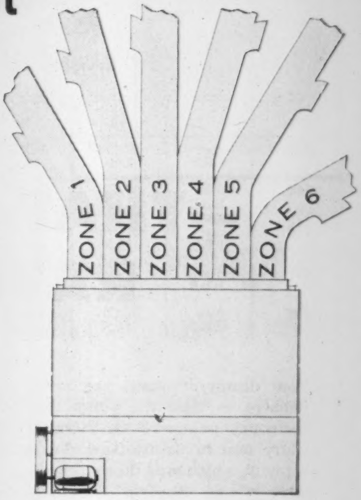
This rugged, compact central plant air conditioning unit supplies air, conditioned for simultaneous unequal heat load demands, in various zones requiring individual temperature and humidity control.

Formerly, heat load variations caused by differences in building construction, changes in occupancy, wind or solar exposure, could be controlled only by separate supply systems for each zone or by expensive zone reheat arrangements.

Now . . . this problem can be solved with a single Westinghouse Multi-Zone Air Conditioning Unit. Efficient . . . economical . . . this versatile unit supplies air—conditioned at a central location—for the individual needs of as many as 12 zones.

This complete unit—fans, coils, motors and starters—is designed and manufactured by Westinghouse, permitting a single equipment warranty with undivided responsibility . . . an exclusive feature in all Westinghouse Air Handling Units.

For complete information about this outstanding advance in central plant air conditioning, call your nearest Sturtevant Sales Engineer today. Or write: Westinghouse Electric Corporation, Sturtevant Division, Boston 36, Mass.



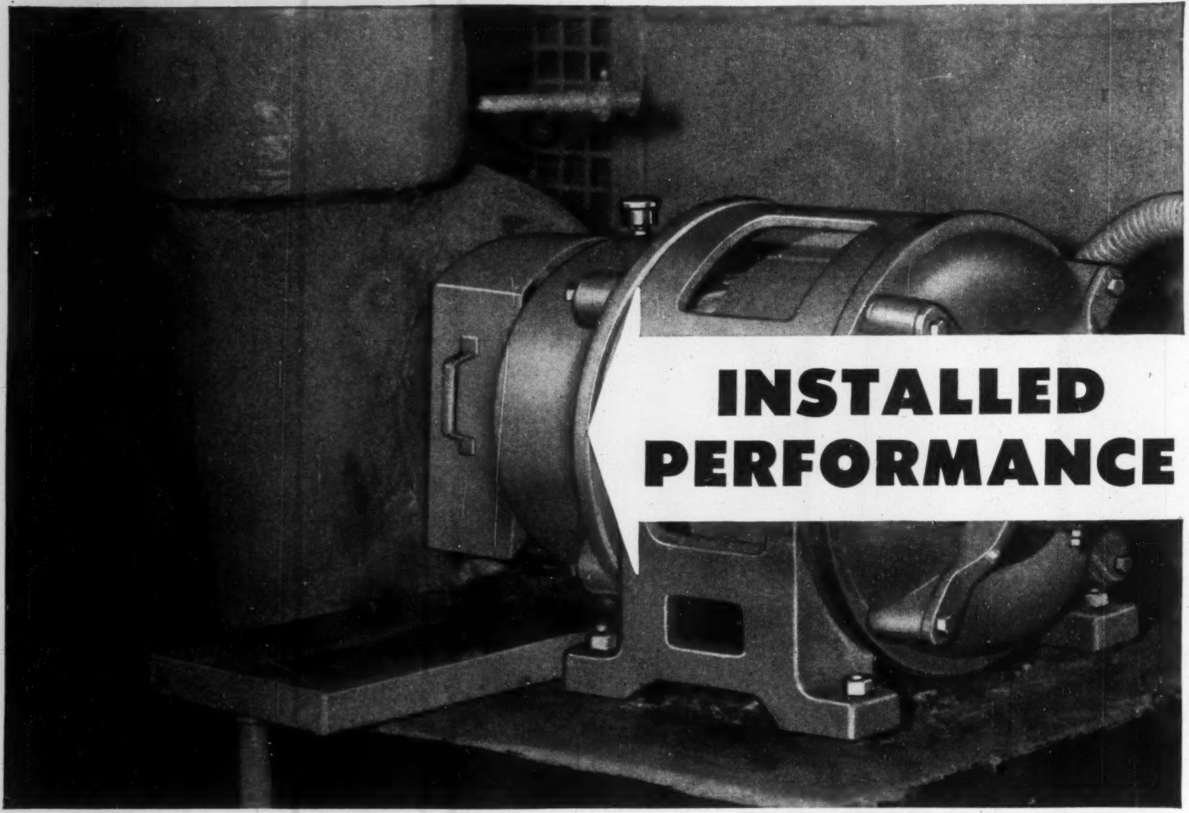
TOP VIEW
(FOR SIX ZONES)

Multi-Zone Units are of the blow-through type with divided outlets to serve multiple zones by supplying heated or cooled air, or controlled mixtures of both, to each zone.

WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE...IF IT'S Westinghouse

I-80393



"Buffalo" Close-Coupled Pump Handling Chilled Water

RATINGS — "BUFFALO" CLOSE-COUPLED PUMPS — 1750 R. P. M.

TOTAL HEAD IN FEET

GPM		70	80	90	100	110	120	130	140	150	160
340	Size BHP	4CCM 7.90	3CCL 10.1	4CCL 10.9	4CCL 12.3	4CCL 13.7	4CCL 15.2	4CCL 16.9	4CCL 18.5	4CCL 19.8	
360	Size BHP	3CCL [illegible]	3CCL [illegible]	4CCL [illegible]	4CCL [illegible]	4CCL [illegible]	4CCL [illegible]	4CCL [illegible]	4CCL [illegible]	4CCL [illegible]	
380	Size BHP	3CCL 10.3	3CCL 11.6	4CCL 11.8	4CCL 13.3	4CCL 14.9	4CCL 16.5	4CCL 18.1	4CCL 19.8	4CCL 21.5	
400	Size BHP	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4CCL 22.3	
420	Size BHP	3CCL 11.8	3CCL 13.0	4CCL 12.9	4CCL 14.3	4CCL 16.0	4CCL 17.7	4CCL 19.4	4CCL 21.2	4CCL 22.7	

—THAT MEETS (OR BEATS) RATED PERFORMANCE

Few disappointments are more aggravating — and expensive — than the pump that fails to deliver the performance promised on paper. It means adding an auxiliary unit or dismantling the installation to replace with a pump which will do the job.

This is why "Buffalo" Pumps are so frequently specified. Since "way back when", these pumps have had the reputation for living up to their ratings, Every "Buffalo" Pump is built to the standards of workmanship and materials required for its intended job — and every "Buffalo" Pump must pass a thorough load test, before it ever leaves the factory.

Take the popular "Buffalo" Close-Coupled Pump above. Heavily insulated-in for long periods of chilled water service, it delivers — and *keeps* delivering — up to rating. Husky and efficient, this compact pump is a long-term money saver. Write for Bulletin 975-D for the facts.

"Buffalo" PUMPS

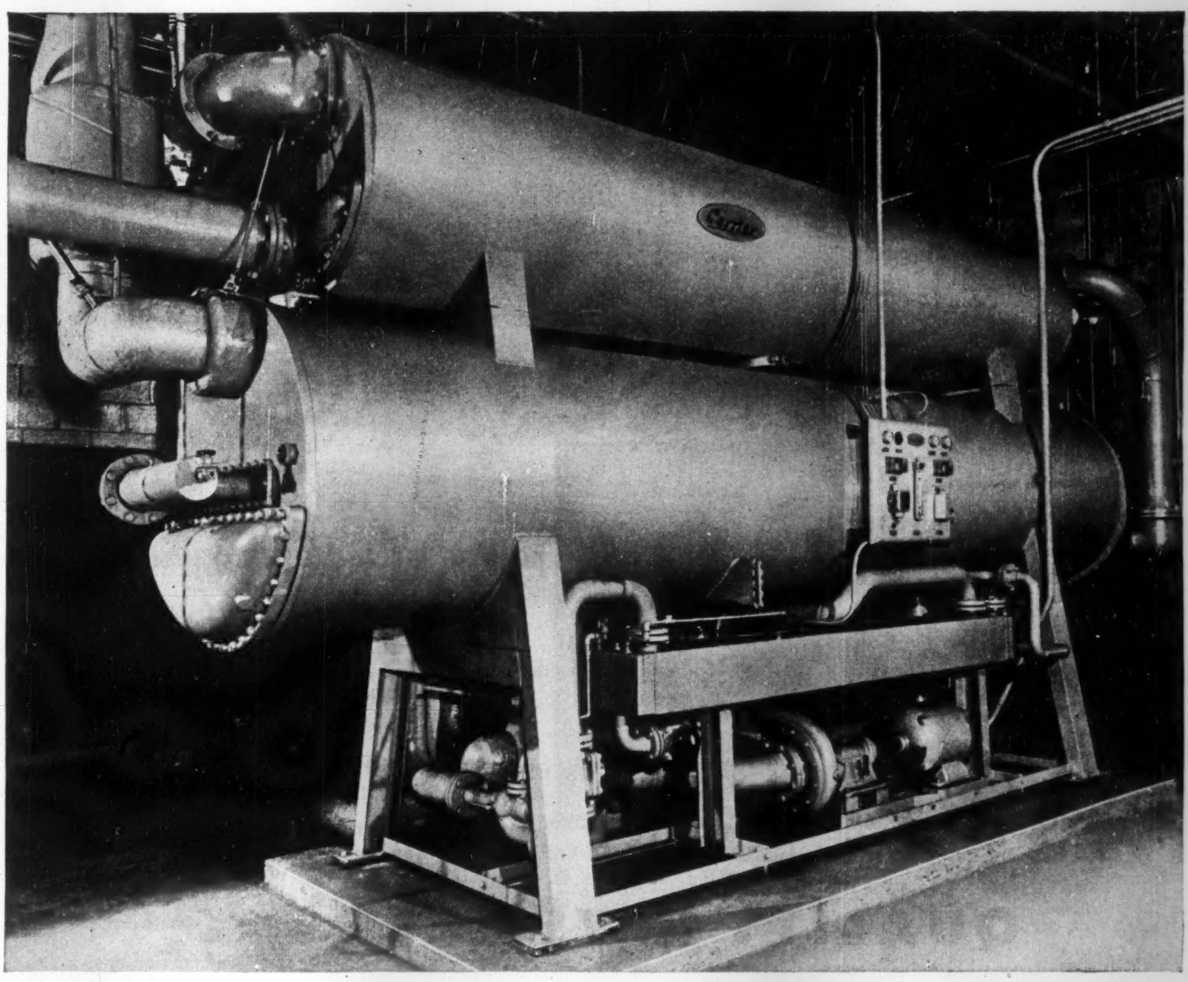
BUFFALO PUMPS, INC.

171 MORTIMER ST. BUFFALO, N.Y.

Subsidiary of Buffalo Forge Company

Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

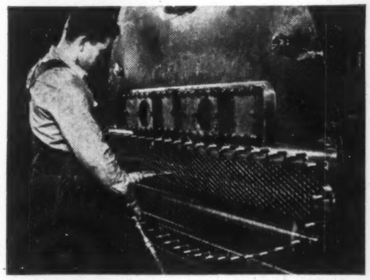


This 350-ton Carrier Absorption Machine is installed at the Joseph Horne Co. Suburban Store in Brentwood Borough, Pennsylvania.

Carrier Absorption Refrigerating Machine uses heat to cut cooling costs

—and AnacondA Cupro Nickel Tubes are again called on for economical quality performance in industry

Until recently, plant and building engineers have been hung on the horns of a cooling dilemma; how to use low pressure steam—frequently exhausted as waste—for chilling water for air conditioning and process cooling. No economical way seemed to exist to harness this heat as a work horse for cooling.



Rolling-in ANACONDA Cupro Nickel Tubes in absorber for new Carrier Absorption Machine.

Carrier Corporation, leading manufacturer of air conditioning and refrigerating equipment, found the solution in *absorption refrigeration.* In 1942, they installed the first pilot plant at the Carrier laboratory using water as a refrigerant and lithium bromide as the absorbent. Since then, a growing number of these large capacity units have been put into operation. They have few moving parts, are practically vibration-free, weigh less per rated ton, and adjust automatically to load.

Carrier selected ANACONDA Cupro Nickel Tubes for use in these machines because of their excellent service record for trouble-free performance under all operating conditions.

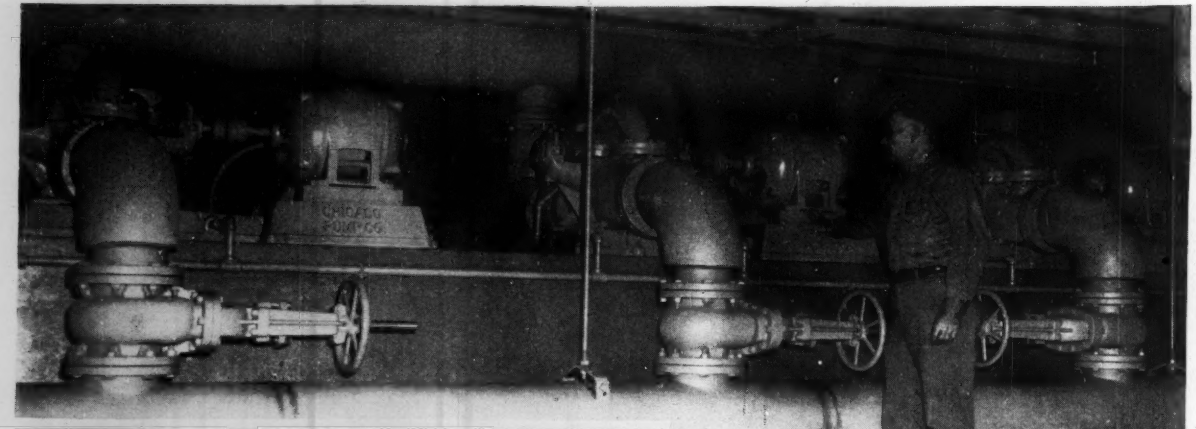
What are your condenser and heat exchanger problems? In selecting the proper tube alloy, the experience of our Technical Department is freely available to you. Use it as a short cut to the right solution. Write to *The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.*

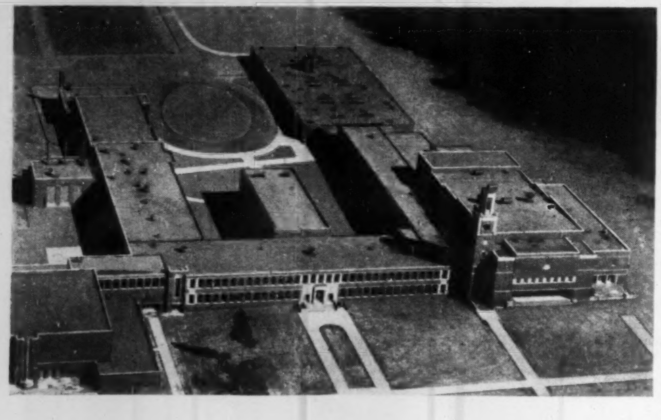
54103

FOR EFFICIENT HEAT TRANSFER

ANACONDA®

HEAT EXCHANGER TUBES





Three Chicago Type D Centrifugal Pumps powered by 25 H. P. motors provide efficient hot water circulation at the Parma, Ohio, Senior High School. Two pumps handle normal loads, the third serves as a stand-by.

The new Parma, Ohio, High School
Architects—Fulton, Krinsky and Dela Motte
Contractors—The Feldman Bros. Co.

QUALITY PAYS HERE . . .

Quality that pays off in the long run was the guiding thought when the Senior High School at Parma, Ohio, was built recently. Costing $5,000,000, the ultra-modern building houses educational facilities for more than 1,500 students. Several hundred rooms, ranging from classrooms to spacious auditoriums and gymnasiums, are heated with hot water circulated to convectors installed throughout the building.

Nothing was spared to make the heating plant efficient and trouble-free. According to Mr. George Rose, long-time heating engineer with the Parma Board of Education, who now operates the Parma heating system, "A 'packaged' heating system might have been adequate but we are already noticing better results from our custom installation."

It is significant that Chicago Pumps — the quality choice of leading architects, engineers and contractors for more than 40 years —are used for hot water circulation in this system. The reputation of Chicago Pumps for efficiency and dependability has earned them a place in many of today's outstanding buildings—for circulating, heating, bilge and sewage pumping. Full information is available on all types. Write for descriptive literature.

CHICAGO
INDUSTRIAL
PUMPS

CHICAGO PUMP COMPANY

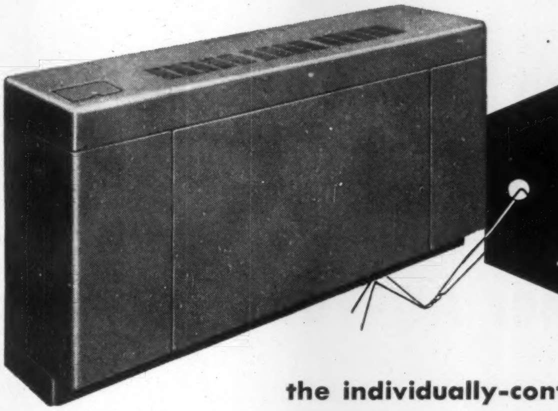
BUILDING and INDUSTRIAL DIVISION

622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Condo-Vac, Sure Return. AVC, LVC,
Fire, House & Circulating Pumps
Pneumatic & Tankless Water Systems.

Flush-Kleen Sewage Ejectors
Little Giant & Non-Clog Bilge Pumps
Pumps for every industrial use.

Check the reasons why the popular choice for summer cooling and winter heating is



The REMOTAIRE
by
AMERICAN-Standard

the individually-controlled unit that filters and circulates the air all year 'round in central-plant, multi-room installations

. . . .

Architects, builders and heating contractors like the Remotaire because it's versatile, easy and economical to install, space saving.

Building owners like the Remotaire because it provides healthful, draft-free comfort conditioning all year 'round with minimum attention.

- ✓ Same simple piping circuit supplies chilled water for summer cooling, hot water for winter heating. No unwieldy ductwork needed.
- ✓ The Remotaire is adaptable to the best system for the job—Wall Aperture System, Interior Ventilation System, Well Water System, Split-coil System, Motel System, Residential System, Modernization System.
- ✓ Units can be installed recessed, partially recessed or free-standing.
- ✓ Three popular sizes to choose from—200, 400, 600 cfm. A size for every job.
- ✓ Easy to service. Every part of the assembly can be reached easily, quickly.
- ✓ Easy to maintain. Motor assembly can be taken out and replaced in less than 15 minutes.
- ✓ Reversible coil is designed for right or left hand connection. Easily reversed in the field.
- ✓ Special electrical junction box is easy to get to.
- ✓ Sturdily built . . . doesn't have to be pampered in installation. (Reinforced grille will support weight of 200 lb. man!)
- ✓ Each unit is individually controlled . . . temperature in each room can be changed without affecting adjoining space.
- ✓ The Remotaire is quiet. No whistling-jet noises.
- ✓ Handsome jacket, furnished in semi-gloss Cooltan, can be painted any color.
- ✓ Toe-step offset permits better fitting of rugs around units and eliminates marring of front when cleaning floors.
- ✓ Drain pan protection. Large pan runs entire length of unit to prevent condensation drip. Grille shield prevents foreign matter from entering through top.
- ✓ Large filters . . . keep air fresh and clean.
- ✓ Adjustable damper. Amount of air intake can be changed at any time.
- ✓ Wall seal. Rubber molding around back panel provides air seal between unit and uneven plaster.

For further information on the Remotaire see Sweet's Architectural File or contact your nearest American-Standard sales office for descriptive literature.

AMERICAN-Standard
WATER HEATING-COOLING SYSTEMS

American Radiator & Standard Sanitary Corporation, P. O. Box 1226, Pittsburgh 30, Pa.

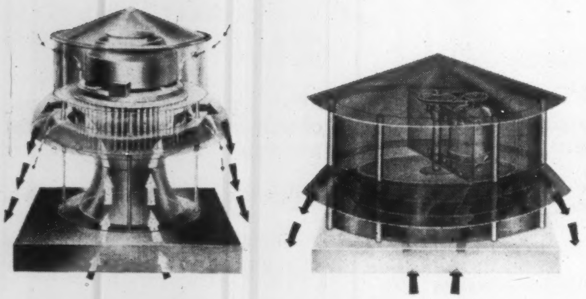
Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

In free air this little gem is a dandy — But if you have static pressure you need Gallaher Air-Vans®

Gallaher units with built-in scroll effect develop up to 4-in. S.P., a figure unapproached by any other power roof exhauster. Performance data is the result of actual physical tests of the unit. Gallaher research indicates that unless scroll effect is present, efficiency against even normal static pressures are unlikely and that in actual test where ratings are predicted, instead of being physically tested, errors may run 50% or more.

It's the reason why so many engineers and architects are specifying Gallaher Air Vans for almost every kind of industrial application where positive air removal is essential.

And these features add to the preference—safe fume removal, low silhouette, heavy lifetime construction, availability in special metals, copper, aluminum, stainless steel, monel, etc., weatherproof design and many others.



Gallaher Air-Vans®

Direct Drive (far left) develops up to 4" S.P. 150 to 11,000 CFM. Belt Drive develops to 4" S.P. 1,000 to 65,000 CFM.

Direct connected, low silhouette, weatherproof and extremely heavy construction.

For full information write

The GALLAHER Company

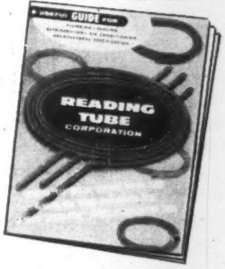
4108 Dodge St. Omaha, Nebraska

MANUFACTURERS OF POWER ROOF EXHAUSTER **BASED** ON DESIGN RESEARCH.

The BEST Distributors in America SELL

READING COPPER TUBE

One of the best ways to judge a product is by the calibre of the distributors who sell it.



NEW CATALOG

Reading's New 32 page guide for Copper Water Tube, Copper Refrigeration Tube, and Red Brass and Copper Pipe is now available. Write for your free copy today.

We, at Reading, consider it highly significant that America's leading distributors have chosen Reading Copper Tube to sell and recommend. These distributors build their business by handling the finest products — products whose quality and performance they can depend on to uphold their reputation for giving customer satisfaction. Of equal importance to them is service. And they know from experience that Reading's streamlined, shirt sleeve service eliminates delays . . . speeds delivery from factory . . . to distributor . . . to contractor. Next time you need copper tube . . . specify Reading . . . precision product of one of America's largest, completely integrated mills, specializing in the processing of copper tube from basic metal to finished tubing . . . and sold by America's best distributors.

READING COPPER · BRASS TUBE

Sold Through Wholesalers Only

READING TUBE CORPORATION

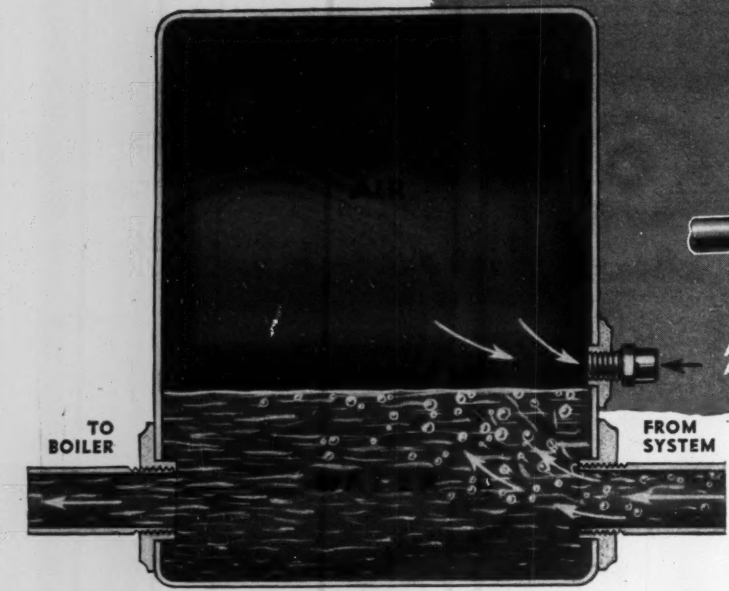
EMPIRE STATE BUILDING, NEW YORK 1, N. Y. PLANT: Reading, Pa.

Distribution Depots:

- READING, PA.
- WOODSIDE, L. I., N. Y. 57-17 Northern Blvd.
- CHICAGO, ILL. 724 W. 50th St.
- HOUSTON, TEXAS, 1121 Rothwell St.
- ATLANTA, GA., 690 Murphy Ave., S.W., Unit 5, Bldg. B
- CLEVELAND, OHIO 4615 Perkins Ave.

END *Air Troubles*

IN HOT WATER HEATING



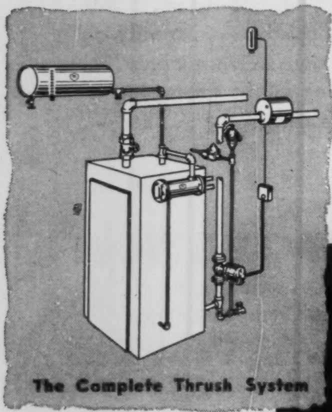
THRUSH
AIR ELIMINATOR

Installed in the return main, the Thrush Air Eliminator collects and eliminates air from water in a hot water heating system.

THRUSH AIR ELIMINATOR

removes air from hot water systems !

THE NEW THRUSH Air Eliminator provides a simple, inexpensive but highly efficient means of collecting and automatically removing air from radiant coils, baseboards or convectors. Air in water moves with circulation and is trapped and released in the Eliminator, thus preventing air from interfering with circulation. This operation is accomplished by breaking the flow of water, which causes air to separate from the water.



The Complete Thrush System

The Thrush Air Eliminator is easy to install in the return main as shown in the system diagram below. It is ruggedly constructed. Each Air Eliminator is shipped in an individual carton, with full instructions.

For real customer satisfaction, install complete Thrush Radiant Hot Water Heat as shown in the illustration at left. For more information see your wholesaler today or write Dept. E-9.

H. A. THRUSH & COMPANY
PERU, INDIANA

Why it pays to specify FEDDERS New Baseboard Radiation

DAMPERS STANDARD EQUIPMENT

Full length deflector is also an adjustable damper to give individual finger tip control. Spare rooms can be closed off, and bedrooms kept at lower temperature with lower fuel cost.

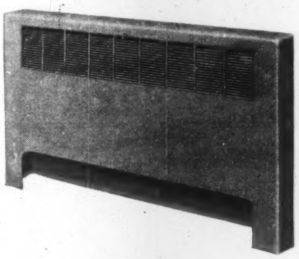
QUICK SNAP-ON INSTALLATION

Covers, corners, joint strips, element and supports come in complete package. No drilling, no mitering, no screws, no tools, no brackets to assemble . . . saves hours. One piece back and top eliminates leakage of heated air. Smooth cover surfaces are free of ribs and grilles. Active but gentle air circulation,— no hot blasts to stir up dust.

● Every new and exclusive feature of FEDDERS latest type Baseboard Radiation is being welcomed by architects, interior decorators, contractors and owners for new and remodeling work. Provides convected and radiant warmth at ankle height all around the room. Finned heating element gives quick response to thermostat.

NEW FEDDERS TYPE F, FE and FB CONVECTOR-RADIATORS with Slide-in Front

Quick, easy installation . smooth front panels, no screws. Complete line of other models for free standing, recessed and picture window installations. Write Dept. HP for Catalog.

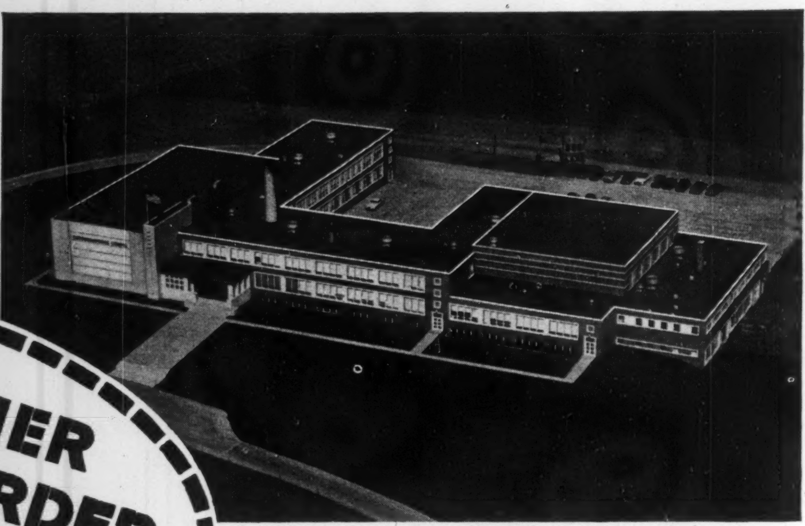


Also manufacturers of Unit Heaters, Wall Radiation and other Heat Transfer Products. Write Dept. HP *for Catalog.*

FEDDERS-QUIGAN CORPORATION

Heating Division TRENTON 7, N. J.

The most convincing stamp of user satisfaction



Susquehannock Junior-Senior High School Southern York County, Pa. *Architect:* Buchart Engineering Corp. *Engineers:* W. K. Hood & Associates. *Heating Contractors:* J. L. Thomas. *Plumbing Contractors:* C. C. Kottcamp & Son.

ANOTHER REPEAT ORDER FOR SARCO

21 times in two years

Buchart Engineering Corporation Specifies Sarco Heating Specialties for School Projects

PLAIN TALK! Here's what the Buchart Engineering Corp., York, Pa., School Designers, has to say about the dependability of Sarco Heating Specialties:

> "*...all our school projects equipped with Sarco traps, temperature regulators, water blenders and heating specialties have had satisfactory, dependable service throughout the years.*"

Sound reason why Sarco products were specified and installed in 21 schools designed by the firm during the last two years.

This record of confidence is convincing testimony to the dependability of Sarco Heating Specialties.

Why not specify Sarco on *your* next project and be assured of the same dependable performance.

Full information on all Sarco products is available on request. SARCO COMPANY, INC., Empire State Building, New York 1, N. Y. Representatives in principal cities.

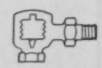
SARCO

Sarco quality assures satisfaction

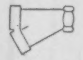
HERE ARE THE 21 BUCHART-DESIGNED PENNSYLVANIA SCHOOLS RELYING ON SARCO HEATING SPECIALTIES

Kennard-Dale Junior-Senior High School
Susquehannock Junior-Senior High School
York Township Elementary School
Red Lion High School
Spring Grove Elementary School
Dover Joint Elementary School
Southampton Township Elementary School
Quarryville Boro Elementary School
Springettsbury Township Elementary School
Spring Grove Joint High School
Jefferson Elementary School
McConnellsburg-Ayr-Todd Elementary School
Union-East Buffalo Elementary School
Pequea Township Elementary School
Mt. Rose Junior-Senior High School
Kennard-Dale Junior-Senior High School Addition
Stewartstown Elementary School Addition
Windsor Township Elementary School
Jackson Township Elementary School
New Salem Elementary Center
Springettsbury Independent Elementary School Addition

STEAM TRAPS • TEMPERATURE CONTROLLERS • HEATING SPECIALTIES



Radiator Valves • Traps



Strainers

Float-Thermostatic Traps

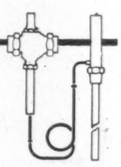
Camlift Bucket Steam Traps

Thermostatic Traps

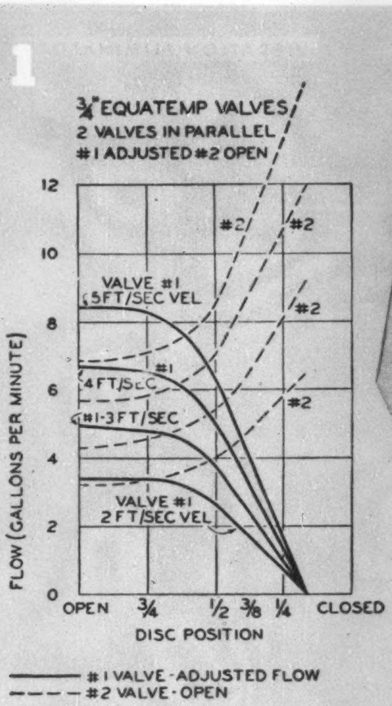
Water Blenders

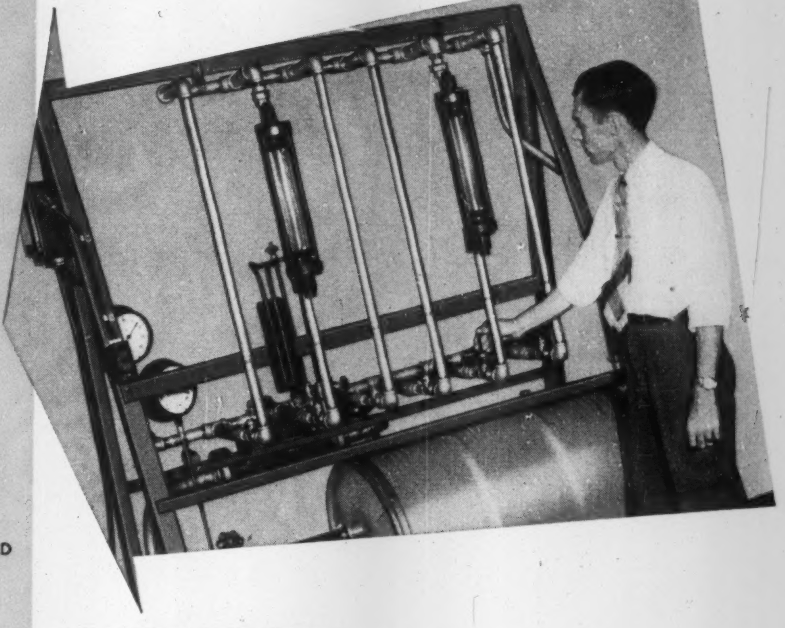
Air Eliminators

Dial Thermometers



Self-Operated Temp. Reg.



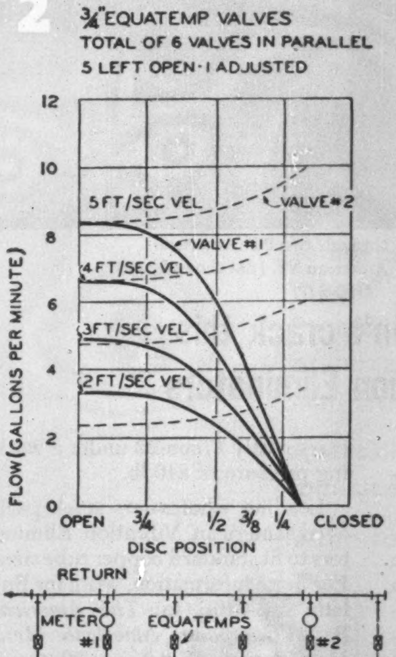


QUESTION:

Does A Balancing Valve Really "Balance"?

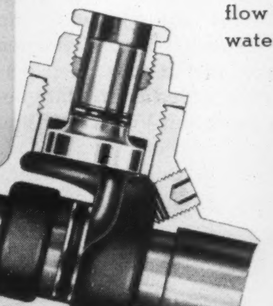
Moving the disc in the O-B Equatemp® Balancing Valve has a definite effect on flow...both in the line in which the valve is installed and on flow in parallel lines in the same system.

That's the point demonstrated by O-B engineers on the special test device pictured here. The charts show how the test works. In chart one, one Equatemp is moved from full open to full closed position. As the valve closes, flow through a parallel open valve begins to increase. The second chart shows the same results when six valves are connected in parallel, although the effect of the adjustment is less because it is distributed over five other lines instead of one.



ANSWER:

An Equatemp Balancing Valve really balances. It can be used effectively to regulate flow in year-around air conditioning and hot water heating systems.

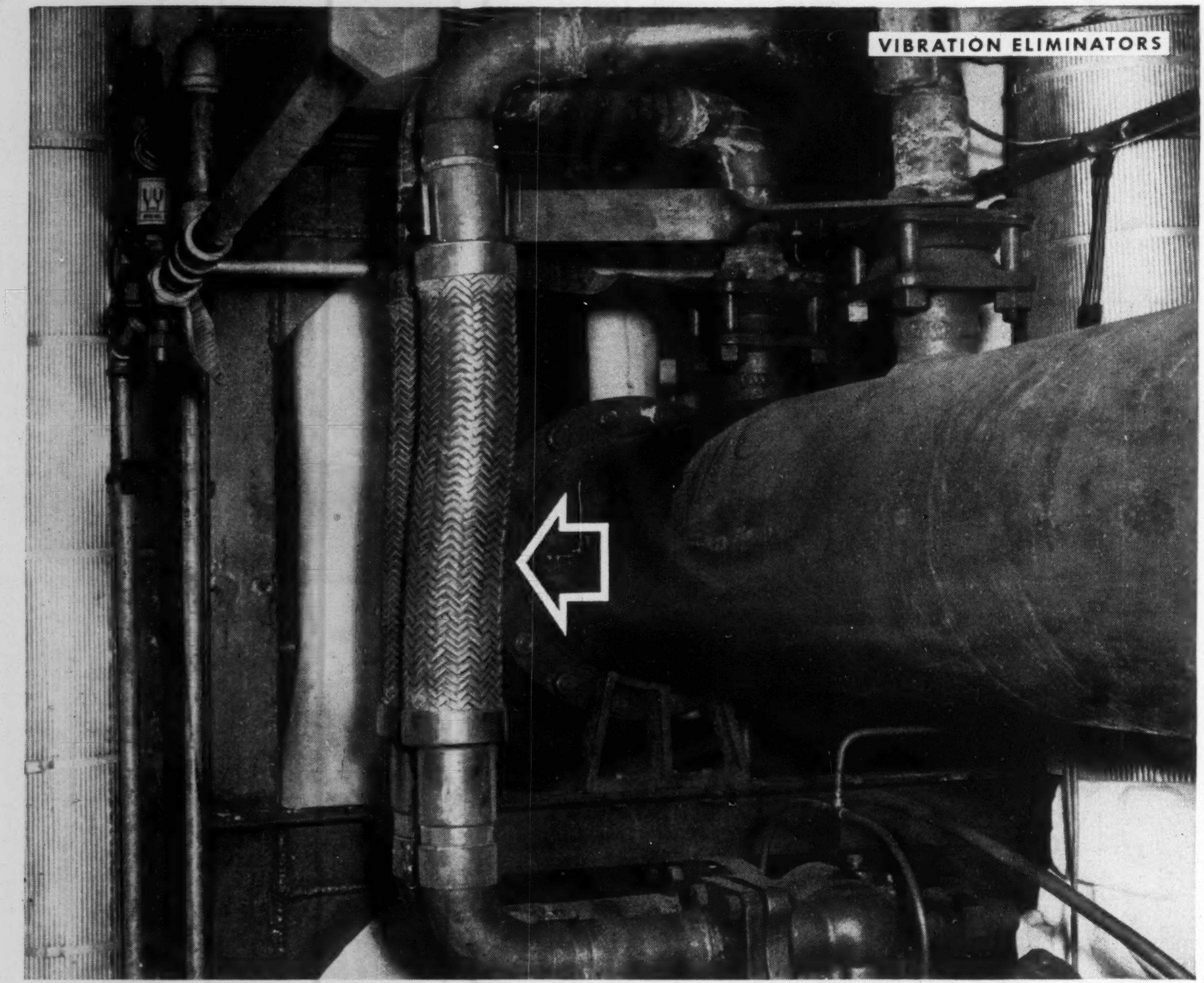


Also available with threaded ends.

Ohio Brass

MANSFIELD **OHIO, U.S.A.**

4462-V



COMPRESSED FREON-22, used to chill brine, is pumped to condenser through two 2½" American Vibration Eliminators. Freon gas returns to compressor through a 3½" American VE (not shown).

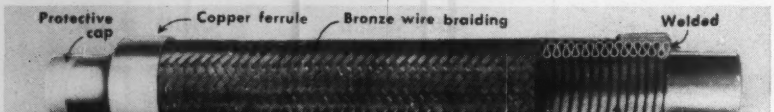
Vibration from 40-hp compressor can't crack this piping protected by American Vibration Eliminators

When you line up a compressor this size—no matter how good the installation—there's sure to be plenty of kick left in it. This unit pounds away at 40-hp and sets up considerable vibration . . . enough to be a menace to rigid refrigerant lines.

Engineers of Hoffmann-La Roche, Inc., Nutley, N. J., manufacturers of pharmaceuticals and vitamins, used two American Seamless Flexible Bronze Connectors — called Vibration Eliminators — to solve the problem here.

These flexible connectors allow for expansion and contraction in rigid lines. They absorb and dampen vibration . . . muffle noise. Refrigerant lines are guarded against fatigue-cracking. American Vibration Eliminators are leakproof, too. That's especially important here, since they carry costly Freon-22 under a working pressure of 210 lb.

Leading wholesalers stock packaged American Vibration Eliminators to fit standard copper tube sizes. For more information, write for Bulletin VE-310R to: *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Co., Ltd.* 54227



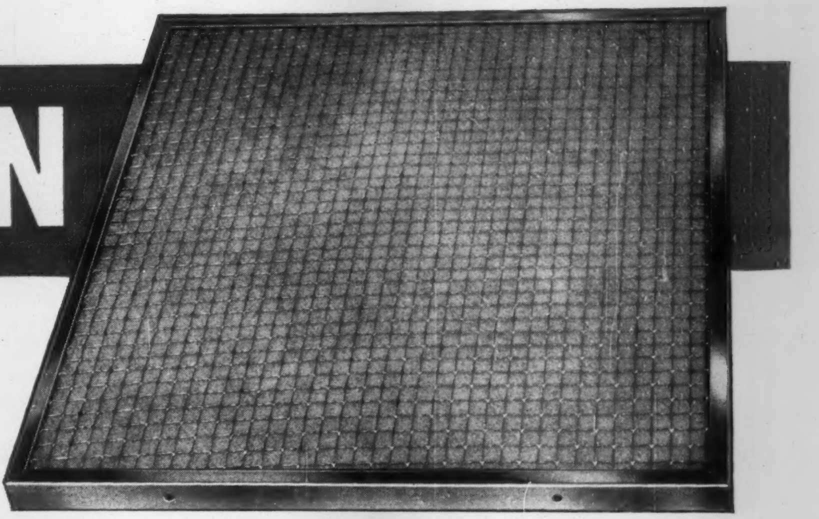
WHEREVER CONNECTORS MUST MOVE

AMERICAN

flexible metal hose and tubing

an ANACONDA® product

DYCON



TYPE DY
ONE-INCH

CONTINENTAL

offers the NEWEST DEVELOPMENT in DRY AIR FILTERS

for air conditioners, warm air furnaces, and air-handling equipment

RINSE and REUSE

DYCON, an un-oiled media of selected synthetic fibers, removes and retains dust particles from the air stream by means of an accumulated static charge. Exceptional capacity means infrequent servicing. Rinse under open water faucet or nozzleless hose, shake out, and return. Rustproof aluminum frame.

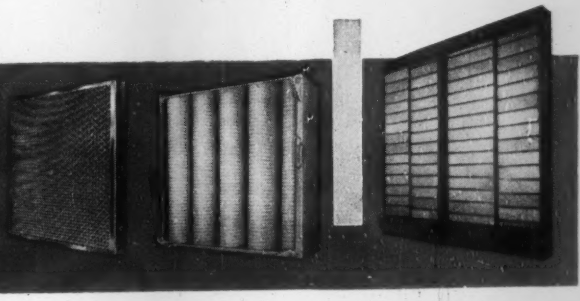
Available in all standard sizes, one-inch thickness . . . in custom sizes at only slight added cost.

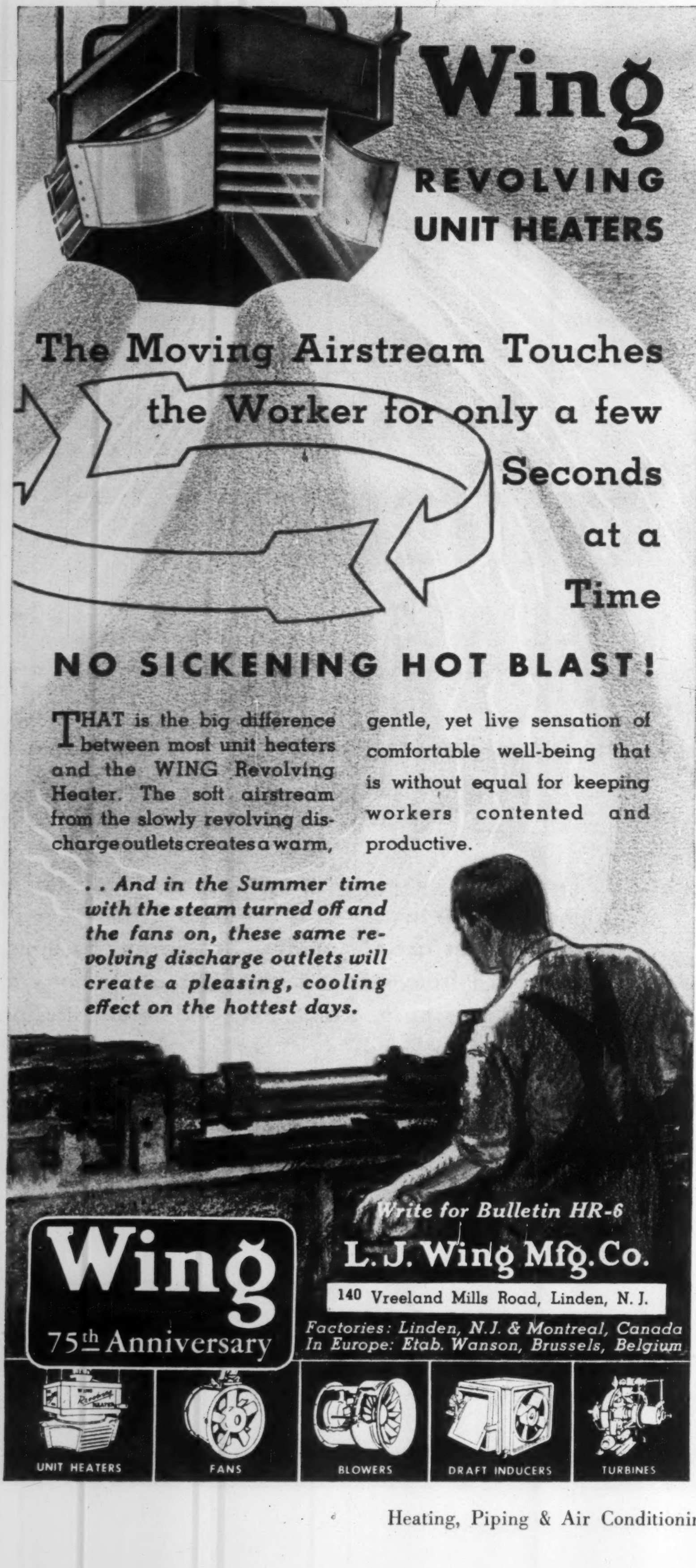
Write today for bulletin No. 550, DYCON Type DY.

CONTINENTAL

P.O. BOX 1647
LOUISVILLE 1, KY.

CONTINENTAL
AIR FILTERS Inc.





Wing

REVOLVING UNIT HEATERS

The Moving Airstream Touches the Worker for only a few Seconds at a Time

NO SICKENING HOT BLAST!

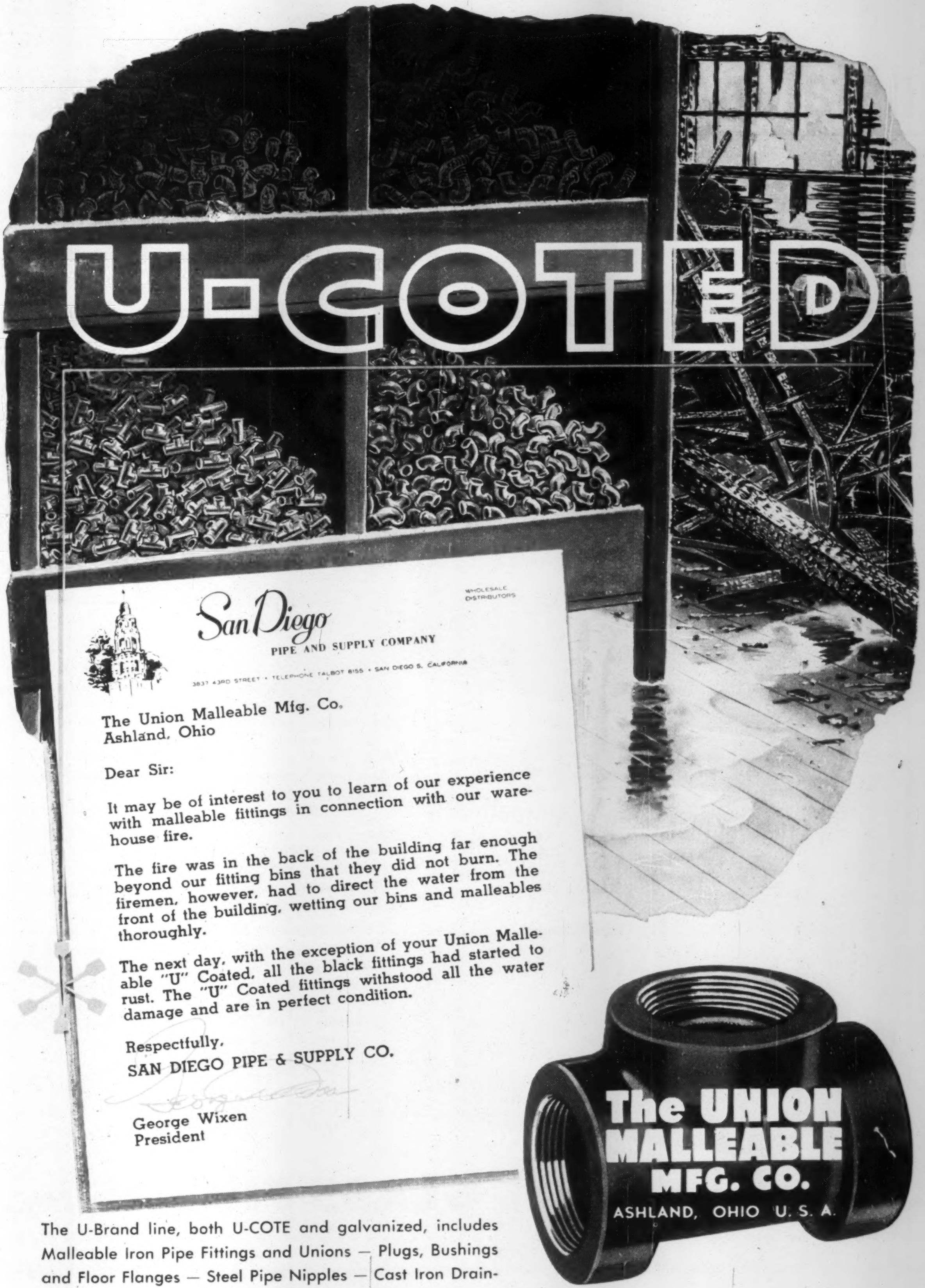
THAT is the big difference between most unit heaters and the WING Revolving Heater. The soft airstream from the slowly revolving discharge outlets creates a warm, gentle, yet live sensation of comfortable well-being that is without equal for keeping workers contented and productive.

. . And in the Summer time with the steam turned off and the fans on, these same revolving discharge outlets will create a pleasing, cooling effect on the hottest days.

Write for Bulletin HR-6

Wing
75th Anniversary

L. J. Wing Mfg. Co.
140 Vreeland Mills Road, Linden, N. J.
Factories: Linden, N.J. & Montreal, Canada
In Europe: Etab. Wanson, Brussels, Belgium



San Diego
PIPE AND SUPPLY COMPANY
WHOLESALE DISTRIBUTORS
3837 43RD STREET • TELEPHONE TALBOT 8155 • SAN DIEGO 5, CALIFORNIA

The Union Malleable Mfg. Co.
Ashland, Ohio

Dear Sir:

It may be of interest to you to learn of our experience with malleable fittings in connection with our warehouse fire.

The fire was in the back of the building far enough beyond our fitting bins that they did not burn. The firemen, however, had to direct the water from the front of the building, wetting our bins and malleables thoroughly.

The next day, with the exception of your Union Malleable "U" Coated, all the black fittings had started to rust. The "U" Coated fittings withstood all the water damage and are in perfect condition.

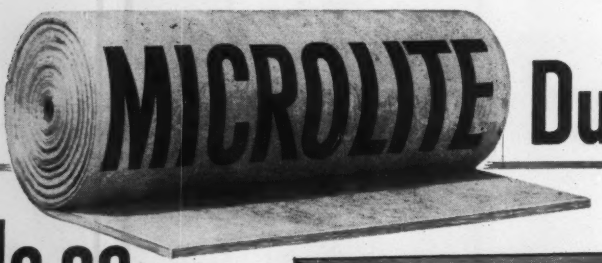
Respectfully,
SAN DIEGO PIPE & SUPPLY CO.

George Wixen
President

The UNION MALLEABLE MFG. CO.
ASHLAND, OHIO U. S. A.

The U-Brand line, both U-COTE and galvanized, includes Malleable Iron Pipe Fittings and Unions — Plugs, Bushings and Floor Flanges — Steel Pipe Nipples — Cast Iron Drainage Fittings and Cast Brass Solder Joint Fittings.

Installing MICROLITE Duct Liner is as Simple as...



(coated or uncoated)

Cut required length and apply to sheet metal with adhesive

Form insulated duct section in brake

Use regular fabricating method (no special procedure required)

Precision cutting and fitting of separate pieces, as with rigid insulation, is just not necessary. Microlite glass fiber duct liner is soft, pliable, pleasant to handle (no itching!) and as simple as A B C to install.

And that's just half the story. Microlite duct liner is a wonderfully efficient acoustical and thermal insulation.

Look:

Sound Absorption Value: ½″ liner has a noise reduction coefficient of .60; 1″ of .80.

Thermal Qualities: "k" value of .20 at 50°, .21 at 75°, .23 at 100°, .27 at 150°, .31 at 200°.

Featherlight too. One-inch liner with coating on one side weighs less than 2¼ ounces per square foot. Excellent air erosion resistance also. Coated liner is recommended for velocities of 1500 feet per minute or over. For velocities up to 1500 feet per minute, uncoated will peform satisfactorily.

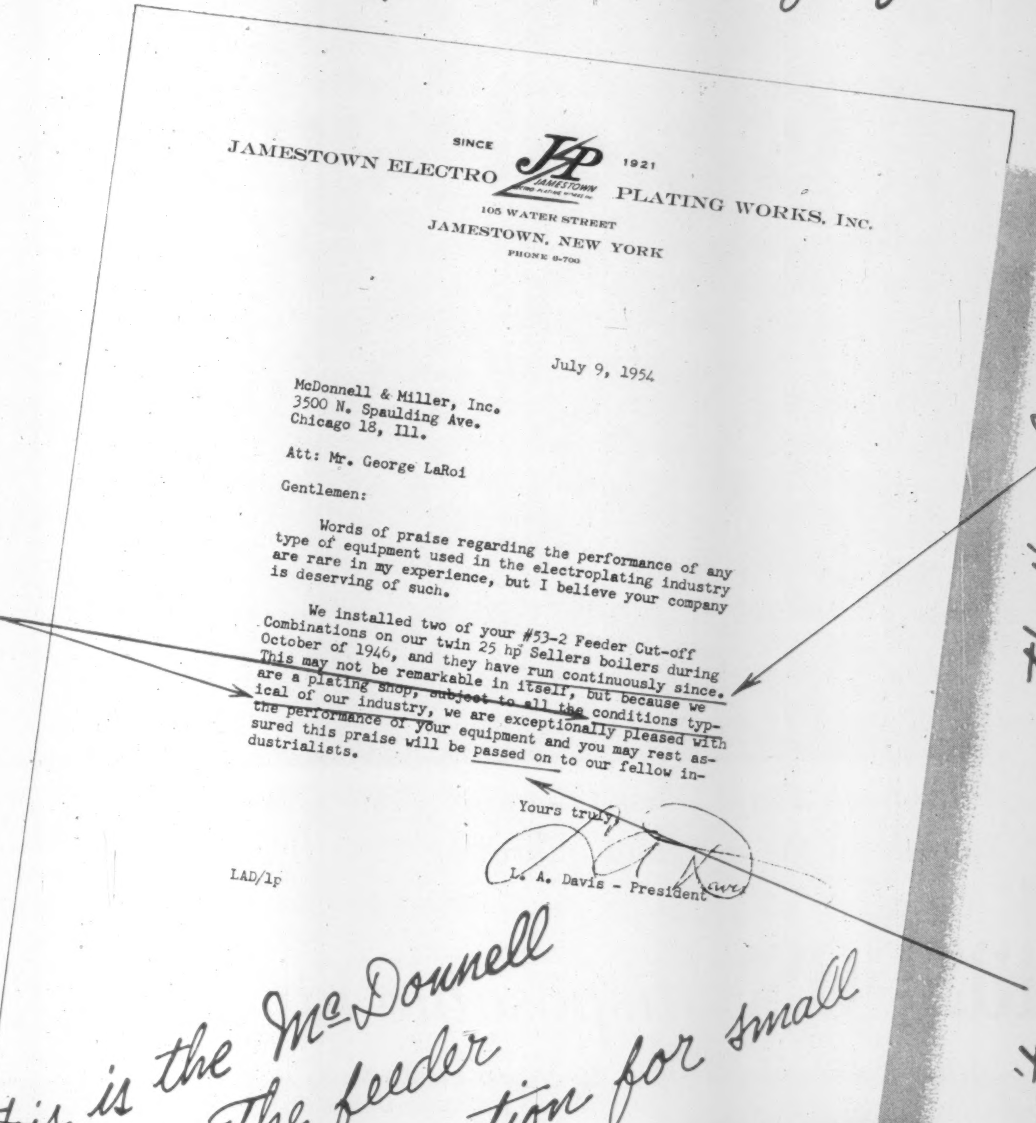
For a technical bulletin and sample, and name of your nearest distributor, write to Glass Fibers Inc., 1810 Madison Avenue, Toledo 2, Ohio.

VITRON Glass Textile Yarns • Rovings • Micro-Fibers
DURAMAT Vapor Barriers • **BLUE FLAG** Pipe Wrap
MICROLITE Thermal and Acoustical Insulation
VIBRAGLASS Mounting and Packaging Materials
COUSTIC-AIRE and **THERMO-JET** Aircraft Insulations

GLASS FIBERS *INC.*

Makers of glass fibers by the ELECTRONIC-EXTRUSION process ... developed, patented and used exclusively by Glass Fibers Inc.

Here's a report on a tough job!



JAMESTOWN ELECTRO PLATING WORKS, INC.
SINCE 1921
105 WATER STREET
JAMESTOWN, NEW YORK
PHONE 6-700

July 9, 1954

McDonnell & Miller, Inc.
3500 N. Spaulding Ave.
Chicago 18, Ill.

Att: Mr. George LaRoi

Gentlemen:

Words of praise regarding the performance of any type of equipment used in the electroplating industry are rare in my experience, but I believe your company is deserving of such.

We installed two of your #53-2 Feeder Cut-off Combinations on our twin 25 hp Sellers boilers during October of 1946, and they have run continuously since. This may not be remarkable in itself, but because we are a plating shop, subject to all the conditions typical of our industry, we are exceptionally pleased with the performance of your equipment and you may rest assured this praise will be passed on to our fellow industrialists.

Yours truly,

L. A. Davis

LAD/lp

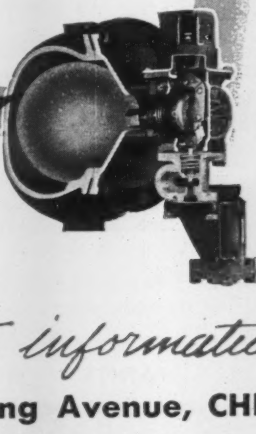
L. A. Davis - President

Corrosive atmospheres!

that's a lot of running — these are process jobs

Why don't you pass the word along, too?

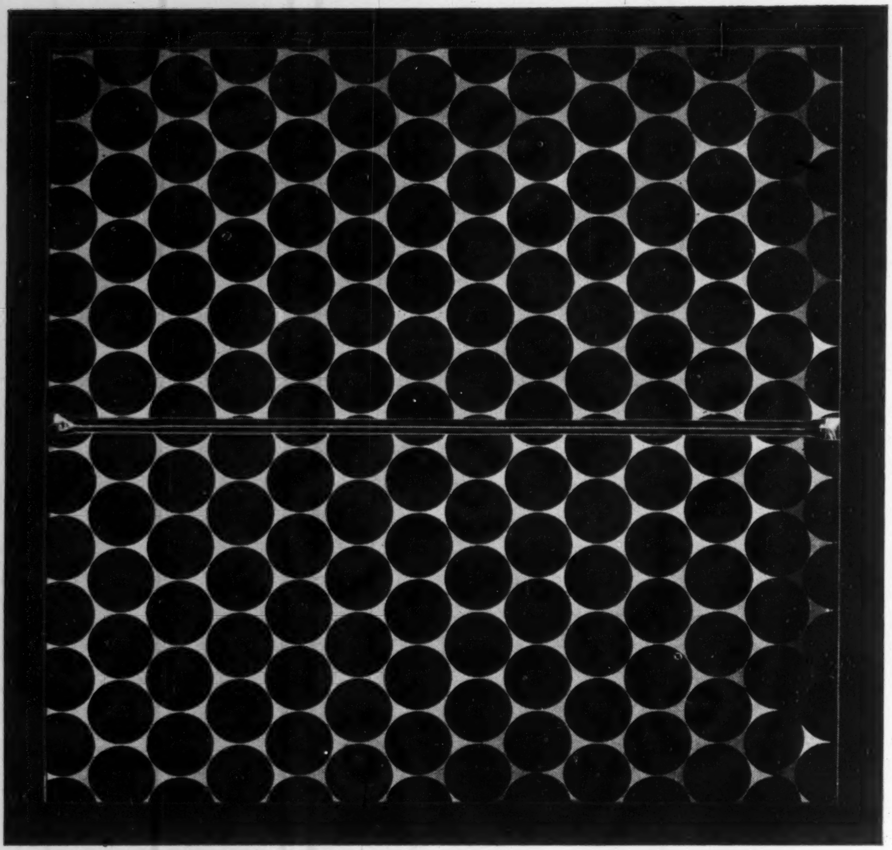
this is the McDonnell No. 53-2 - the feeder cut-off combination for small process steam boilers up to 75 lbs.



Write for complete information to...

McDONNELL & MILLER, Inc., 3500 N. Spaulding Avenue, CHICAGO 18, ILL.

Doing One Thing Well



Pittsburgh Plate Glass Company, Fiber Glass Division introduces the new and improved

Glasfloss *disposable air filters . . .*

Adds these advantages to your customers' air filtering system—

Easy on the hands—Silky Glasfloss fibers are pleasant to the touch, and non-irritating. Replacements are handled faster and easier. This ease in handling plus more effective filtering action enables Glasfloss Filters to really reduce filtering costs.

Stops and holds more dust—The new Glasfloss Air Filters employ exceptionally fine, long glass fibers that increase the filtering area. Surface loading is greatly minimized, and dirt is accumulated *within the filter*.

Allows freer flow of air—Because of the fineness of glass fibers used, and the scientific interweaving within the filter, Glasfloss Filters offer less resistance to air flow—thereby extending life of blowers and mechanical working parts.

Prove Glasfloss efficiency for yourself—Write today for demonstration tests and complete facts on new, improved Glasfloss Filters. Direct your inquiry to our executive offices, or district sales offices in Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, or St. Louis. Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.

FIBER GLASS PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS

PITTSBURGH PLATE GLASS COMPANY

BRIDGEPORT COPPER WATER TUBE FOR VENTS AND DRAINS

offers more plus benefits

+ Lower Installed Cost . . .
Bridgeport Copper Water Tube can be installed in a fraction of the time needed for other materials—copper tube can be pre-cut and pre-assembled.

+ Longer Life—Lower Maintenance . . .
Drainage lines of Copper Tube never rust—often outlast the life of buildings—give lasting owner satisfaction on new construction or replacement use.

+ More Economical Layout and Design . . .
Bridgeport Copper Water Tube requires less space than other materials—can be laid out more efficiently—offers savings in multiple installations.

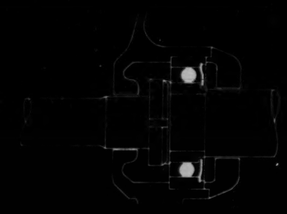
Bridgeport Copper Water Tube in large diameters for soil, waste and vent lines is available from leading wholesalers everywhere. They also carry smaller sizes of Bridgeport Copper Tube for water-supply and heating lines—now available in Bridgeport's new individual coil cartons.

BRIDGEPORT BRASS
COMPANY ◆ BRIDGEPORT, CONNECTICUT
Sales Offices in Principal Cities—Conveniently Located Warehouses
Mills at Bridgeport, Conn., Indianapolis, Ind., Adrian, Mich.
In Canada: Noranda Copper and Brass Limited, Montreal

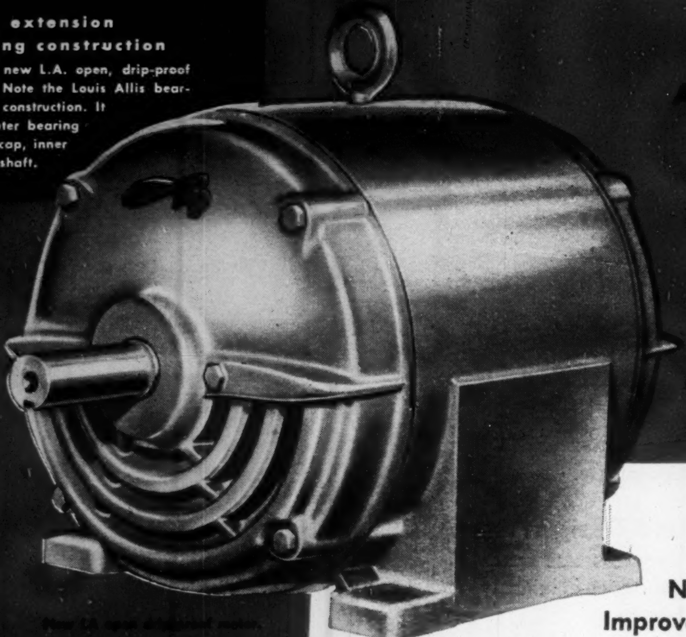
Here's another reason why *the* NEW L.A. *Line*

by the Louis Allis Co.

is your BEST *electric motor* BUY



Shaft extension bearing construction
used in new L.A. open, drip-proof motors. Note the Louis Allis bearing-cap construction. It locks outer bearing race to cap, inner race to shaft.



New L.A. open drip-proof motor.

A brand-new power package, completely redesigned inside and out

with NEW BEARING CONSTRUCTION

plus
New modern styling
More compact design
New conduit box arrangement
Improved ventilation and better protection
More versatile mounting

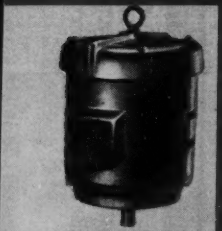
HERE'S the locked bearing construction that makes the new L.A. motors even better—gives them extra life, extra dependability. It positions the rotor . . . limits shaft end-play . . . gives you ample V-belt drive capacity. You get factory prelubrication, too, with a new, improved grease-retaining system that saves servicing and maintenance — for years of attention-free operation under most conditions.

That's not all! You get standard bearings in every unit — sizes specially selected to be easily obtainable from local stocks. And there's no need to tear the motor down to get bearing numbers — they're stamped right on the new motor nameplate.

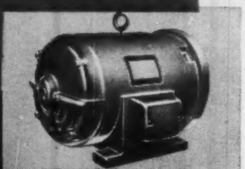
Add this modern, dependable bearing construction to all the other features and you see why the L.A. line is your best motor buy. Get the complete story from your nearby Louis Allis Sales Engineer.

We specialize in SPECIAL MOTORS *and* PROMPT DELIVERY, TOO

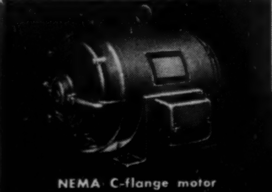
There's a Louis Allis special motor for your toughest application. Whatever electrical or mechanical modifications you need, check first with Louis Allis.



Vertical NEMA C-flange motor



NEMA D-flange motor



NEMA C-flange motor

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

LA-105

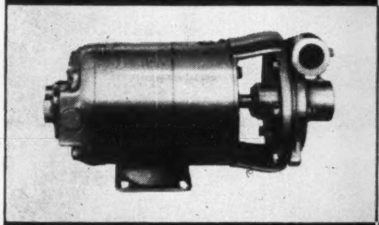
LOOK TO THE LEADER—*LOOK TO PEERLESS*

For All Your Needs for END-SUCTION PUMPS

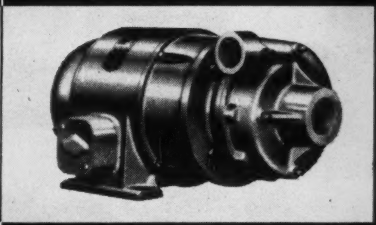
IT'S THE PEERLESS *Fluidyne* LINE

FOR ALL THESE MODELS

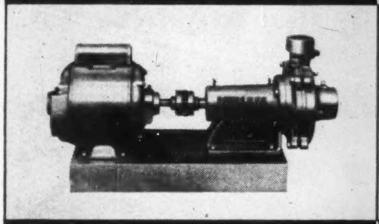
¼-1½ hp FACEMOUNT



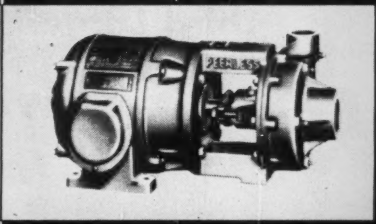
2, 3, 5 hp FACEMOUNT



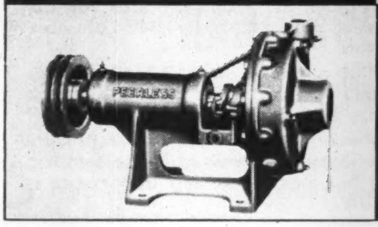
FLEXIBLE-COUPLED Fractional hp



5-50 hp DIRECT CONNECTED



FLEXIBLE-COUPLED Integral hp



FLUIDYNE LINE CHARACTERISTICS

HEADS:	Up to 260 ft.
CAPACITIES:	5 to 5500 gpm
MOTOR SIZES:	¼ to 150 hp

It's the Fluidyne Line for ALL THESE OUTSTANDING FEATURES:

They're ECONOMICAL. Designed with economy in first cost, installation, maintenance and operation in mind—all without compromise in quality.

They're DURABLE. Every consideration has been given in design and construction to assure long service life even under abnormal service.

They're EFFICIENT. In all sizes, types and models the Fluidyne line is characterized by high performance ratings.

They're VERSATILE. Indoors or out, every general utility pumping service can use Peerless Fluidyne Pumps.

They're COMPACT. Space costs money; Fluidyne pumps fit neatly into both piping and pumping layouts as well as into sub-assemblies.

They're EASILY MAINTAINED. No special tools are required to perform ordinary pump maintenance in the Peerless line.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Address Inquiries to Factories at:
Los Angeles 31, California or Indianapolis 8, Indiana
Offices: New York; Atlanta; St. Louis; Dallas, Plainview and Lubbock, Texas; Albuquerque; Phoenix; Los Angeles; Fresno

PEERLESS PUMPS

fmc

PEERLESS PUMPS

For All Your Air Conditioning Applications There's One Line of Pumps That Has Been Proved—The Peerless Fluidyne Line.

THOUSANDS SOLD FOR:
(1) COOLING TOWERS
(2) CHILLED WATER SERVICE
(3) HEAT EXCHANGERS
(4) COMMERCIAL AND RESIDENTIAL AIR CONDITIONING
(5) BOOSTERS
(6) TRANSFER SERVICE

ALSO CHOOSE PEERLESS FOR THESE OUTSTANDING MECHANICAL FEATURES

Stainless Steel Shaft
(Rust-Proof—Corrosion-Free)

Mechanical Shaft Seal (Leak Proof)
In Models up to 5 hp Type PE
In Models up to 1½ hp Type PB

Bronze Impeller
(Same as used in Largest, Highest Quality Industrial Pumps)

Cast Iron Case
(Heavy and Durable)

Nationally-Known Motor Brands
(Fully Guaranteed)

Mail Coupon Today for 24-page Bulletin

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
301 W. Ave. 26, Los Angeles 31, California

Please send me a copy of Peerless Fluidyne Line Pump Bulletin No. B-2300.

NAME____________________
COMPANY____________________
STREET____________________
CITY__________STATE__________
HP&AC

There are 27 big buildings like this. Note impressive panorama of entire development below.

This is Boston's $20,000,000 Housing Development

Architect
M. A. Dyer, Boston
Engineer
J. A. McCusker Co., Boston
Heating Contractor
M. J. Flaherty Co., Boston

Largest in New England—Third Largest in the World—

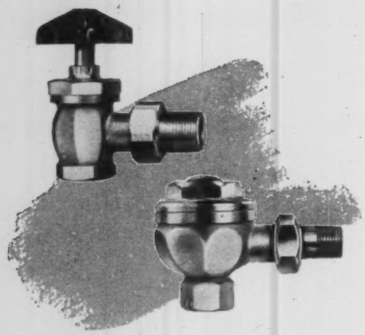
Marsh Valves and Traps all the way

A city in itself! Fifteen seven-story buildings. Twelve three-story buildings. Housing for 1504 families. Fifteen acres of play area for the youngsters. That is a bird's-eye glance at the vast, $20,000,000 Columbia Point Housing Development in Boston.

It takes a lot of heat to keep the 9000 rooms of these 27 big buildings comfortable in New England winters . . . in fact it takes the largest low-pressure heating plant ever built in New England!

This job was too big to take chances. So Marsh Valves and Traps were installed throughout the giant distribution system. It is the familiar story of *Marsh throughout* for the big jobs where top importance is placed on efficiency and dependability.

And remember this: no job is *small* enough to gamble on. For your next installation, large or small, use the valves, traps, and vents that have earned the confidence of the most critical heating engineers and contractors.



America's finest packless radiator valve and the radiator trap to go with it. Sizes and patterns for all requirements.

Dependable is the word for the broad line of Marsh Float and Thermostatic Traps. Sizes and types for all heating services.

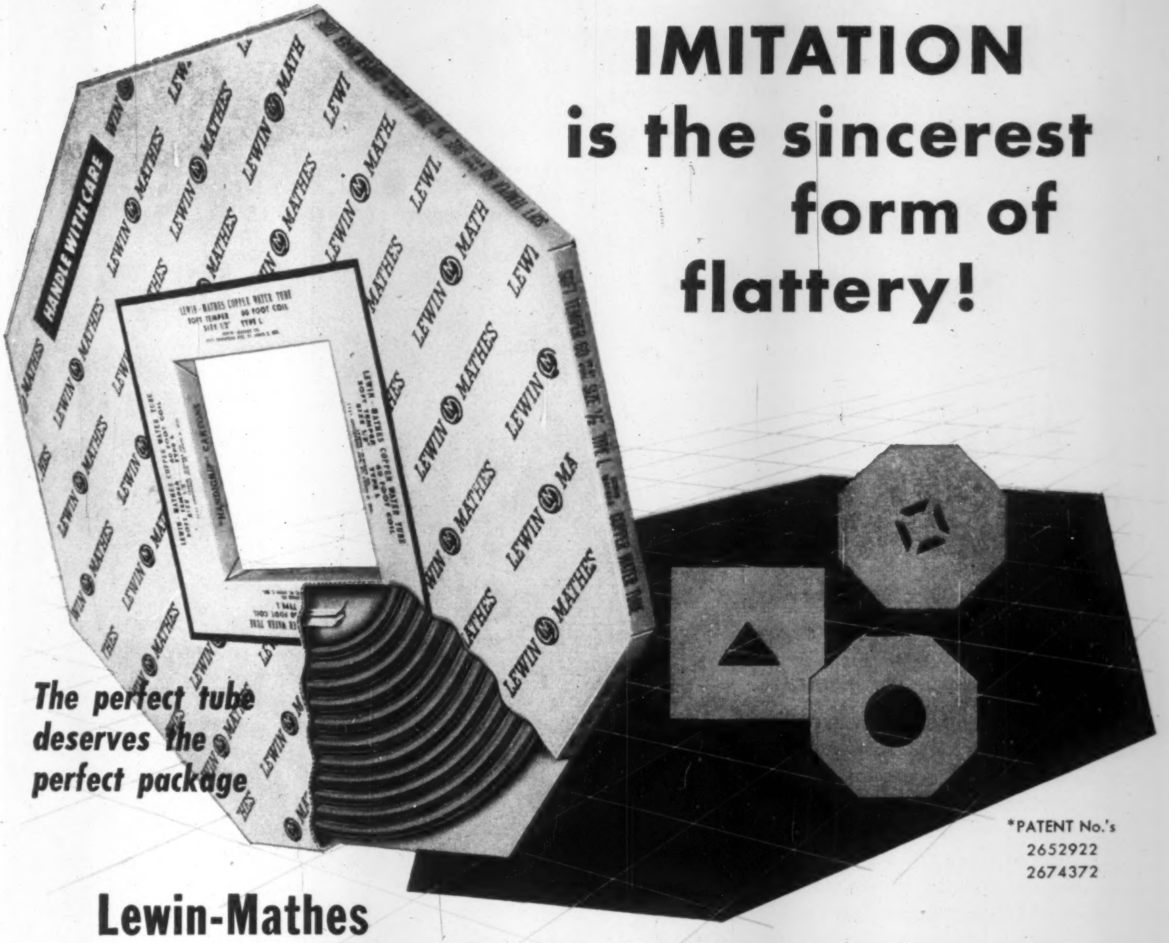
Ask for Catalog 76-H covering the full line of Marsh Heating Specialties

MARSH HEATING EQUIPMENT CO.
Sales affiliate of Jas. P. Marsh Corporation
Dept. T, Skokie, Ill.

MARSH

Quality Heating Specialties **SINCE 1865**

IMITATION is the sincerest form of flattery!



The perfect tube deserves the perfect package

*PATENT No.'s
2652922
2674372

Lewin-Mathes HANDIGRIP CARTON* really started something!

In June 1950 Lewin-Mathes revolutionized the packaging of copper tube when they *first* introduced the now-famous Handigrip Carton. Now manufacturer after manufacturer is adopting similar type packages. Outwardly they may seem to be the same, but, upon examination, the obvious advantages of the Lewin-Mathes Handigrip Carton are easily recognized. The Handigrip Carton's *patented* construction and strength features *cannot* be copied!

AVAILABLE THROUGH YOUR WHOLESALER

Others may be similar *but* only Lewin-Mathes' Patented HANDIGRIP CARTON* has *all* these features:

- **EASY TO CARRY, EASY TO STOCK**... because of the octagon shape and the square hole in the center.
- **MAXIMUM PROTECTION**... weight rests on the corners of the carton *NOT* the coil.
- **DUST-PROOF**—wrap-around construction assures no open edges.
- **EASY TO IDENTIFY**... size and type can be read in any position without moving carton.

ALWAYS LOOK TO LEWIN-MATHES FOR ADVANCEMENT IN THE INDUSTRY!

LEWIN MATHES

LEWIN-MATHES COMPANY • • SAINT LOUIS, MISSOURI
MANUFACTURERS OF COPPER AND BRASS TUBE, PIPE AND FITTINGS

nyb

UNIT HEATERS

BUILT TO MEET MODERN INDUSTRIAL REQUIREMENTS

For Continuous Heat Service up to 150 Pounds Steam Pressure

Horizontal Type

Ceiling suspension type with heavy duty welded steel fin-and-tube heating element. The rugged arc-welded construction outperforms and outlasts heating elements made of thinner non-ferrous metals. Avoids their expansion-contraction faults, yet has the same BTU efficiency. Ten basic sizes with capacities from 30 Mbh to 490 Mbh. Totally enclosed motors. (Extra heavy non-ferrous coils also available.)

Vertical Projection Type Also Available

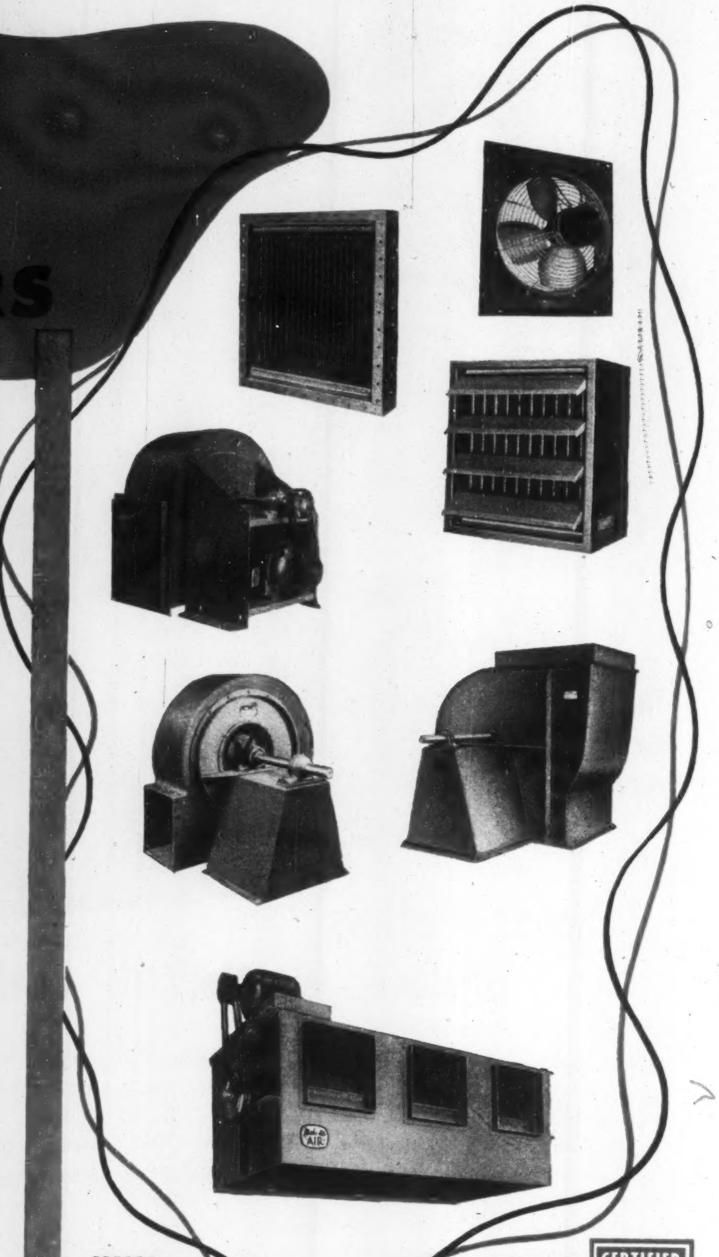
For efficient heating from high-ceiling areas—for door heaters over small openings—or where the horizontal type is not applicable. Ten basic sizes; capacities from 27 to 332 Mbh.

Write for Bulletins

No. 513 Horizontal Type

No. 516 Vertical Type

nyb



IUHA
HEAT WITH UNIT HEATERS

SEE OUR CATALOG IN SWEET'S

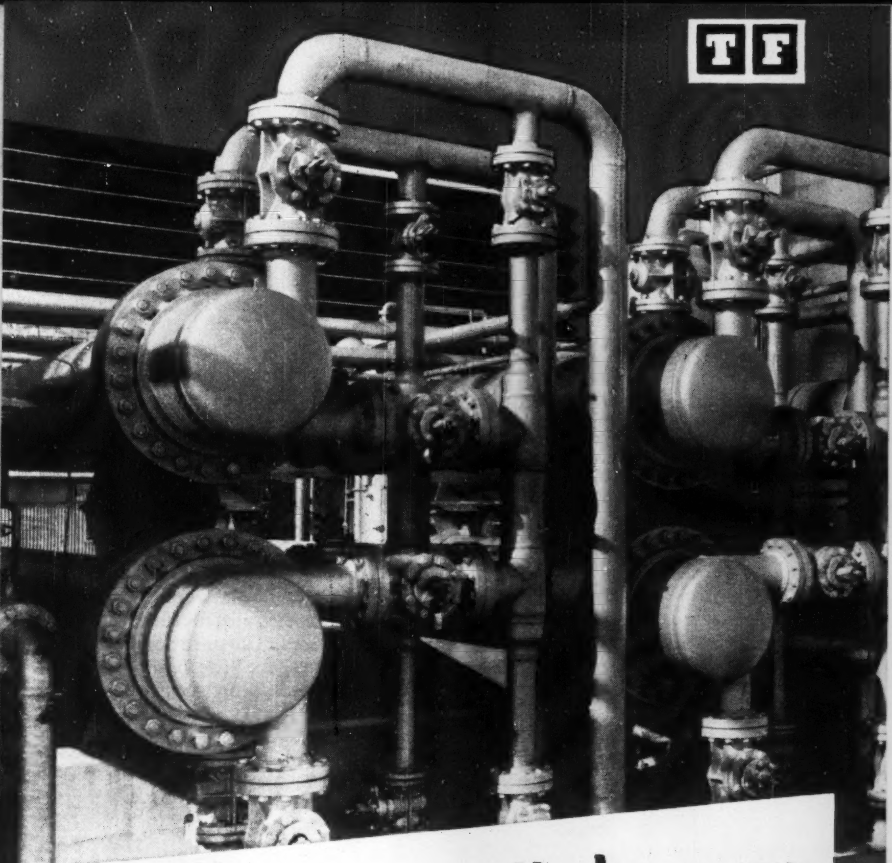
CERTIFIED RATINGS

All New York Blower Company products are laboratory tested, accurately rated and fully guaranteed in strict accordance with Standard Test Codes.

THE NEW YORK BLOWER COMPANY

SALES OFFICES • 3159 SOUTH SHIELDS AVENUE • CHICAGO 16

FACTORY, LAPORTE, INDIANA



Taylor Forge all the way

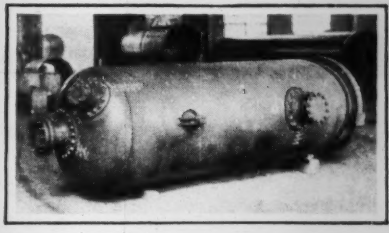
Throughout the power and process industries you will see hundreds of model installations like this where someone who wanted to be sure has specified Taylor Forge all the way through... WeldELLS,® flanges, welding necks, nozzles.

Whatever your needs—simple or complex—it will pay you to *use* all the way through, the products that have *led* all the way through.

See your Taylor Forge Distributor for up-to-the-minute facts.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS • General Offices and Works:
P.O. Box 485, Chicago 90, Illinois • *Offices in all principal cities*
Plants at: Carnegie, Pa.; Fontana, Calif.; Gary, Ind.; Hamilton, Ontario, Canada



A New Development that's 37 Years Old

When you cut a hole in the shell of a pressure vessel you of course weaken it. But, how much?...or, to put it another way, how much reinforcement is necessary to make the shell surrounding an opening as strong as any other part of the shell?

In the old days of low pressure and over-sizing that hadn't been much of a problem. But when pressures began to climb fast (about 1915) it became a tough one.

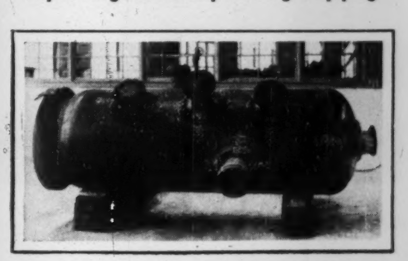
Taylor Forge had already begun to relish problems like this: had pioneered the forged steel flange; was playing a major part in the development of flange and piping standards. So it isn't at all surprising that Taylor Forge again came forward with the solution — the first seamless forged steel pressure vessel nozzles.

The research and testing that Taylor Forge put into designed pressure vessel outlets dates back to the riveted, sweep nozzles that are still giving safe, satisfactory service. But as riveting gave ground to welding, still more critical analyses were made to determine the exact requirements of nozzles designed for welding.

These many years of tests and studies were fully summed up in a paper entitled "Effects of Openings in Pressure Vessels" which was presented by the late J. Hall Taylor and Professor E. O. Waters at the June 1933 meeting of the ASME. It is still authoritative in this field.

Yes, a new idea that is 37 years old! So thoroughgoing was its first development—so critical the steps taken to maintain its leadership—that today Taylor Forge Seamless Nozzles and Welding Necks are the standards of the entire pressure vessel and piping industry.

An episode in the story of Taylor Forge leadership in designed piping



for Rust-Free Hot Water

look for the Copper Lining—

they did at the

New 525 Wm. Penn Place Building

Take a tip from men who specify hot water storage heaters for America's important buildings: "look for the p-k copper lining."

High above Pittsburgh's famed Golden Triangle, towers a glistening new skyscraper. This magnificent 41 story structure houses the main offices of the United States Steel Corporation and the Mellon Banking interests. From tower to basement, 10 **p-k** copper-lined storage heaters provide an abundant supply of rust-free hot water.

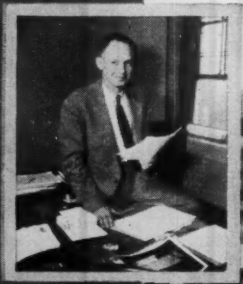
These heaters have been in operation since the building opened in 1952. Because of the corrosiveness of water in the area, the performance record of the heaters is already noteworthy.

Paul L. Flemm, Building Engineer, is enthusiastic about **p-k** heater operation. "Heating water costs money. Trouble-free operation keeps costs down. We haven't had a single case of trouble with the **p-k** heaters . . . to date no cause to expect any. We . . . expect much better service than we would get from heaters made of ferrous metals."

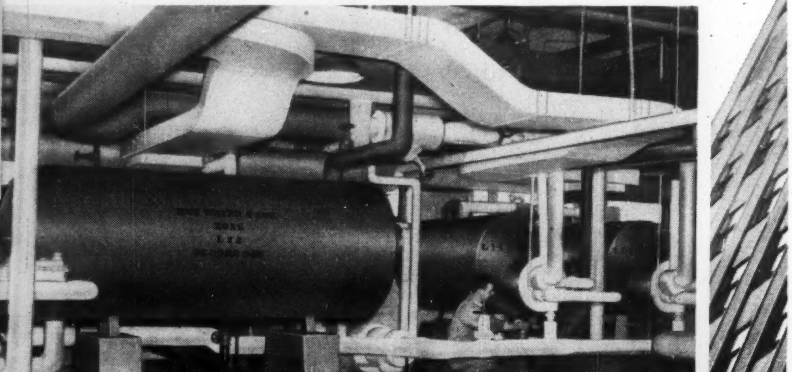
For an unfailing source of pure, rust-free hot water—

LOOK FOR THE **p-k** Copper Lining.

Complete catalog gives all the facts. It's yours for the asking.



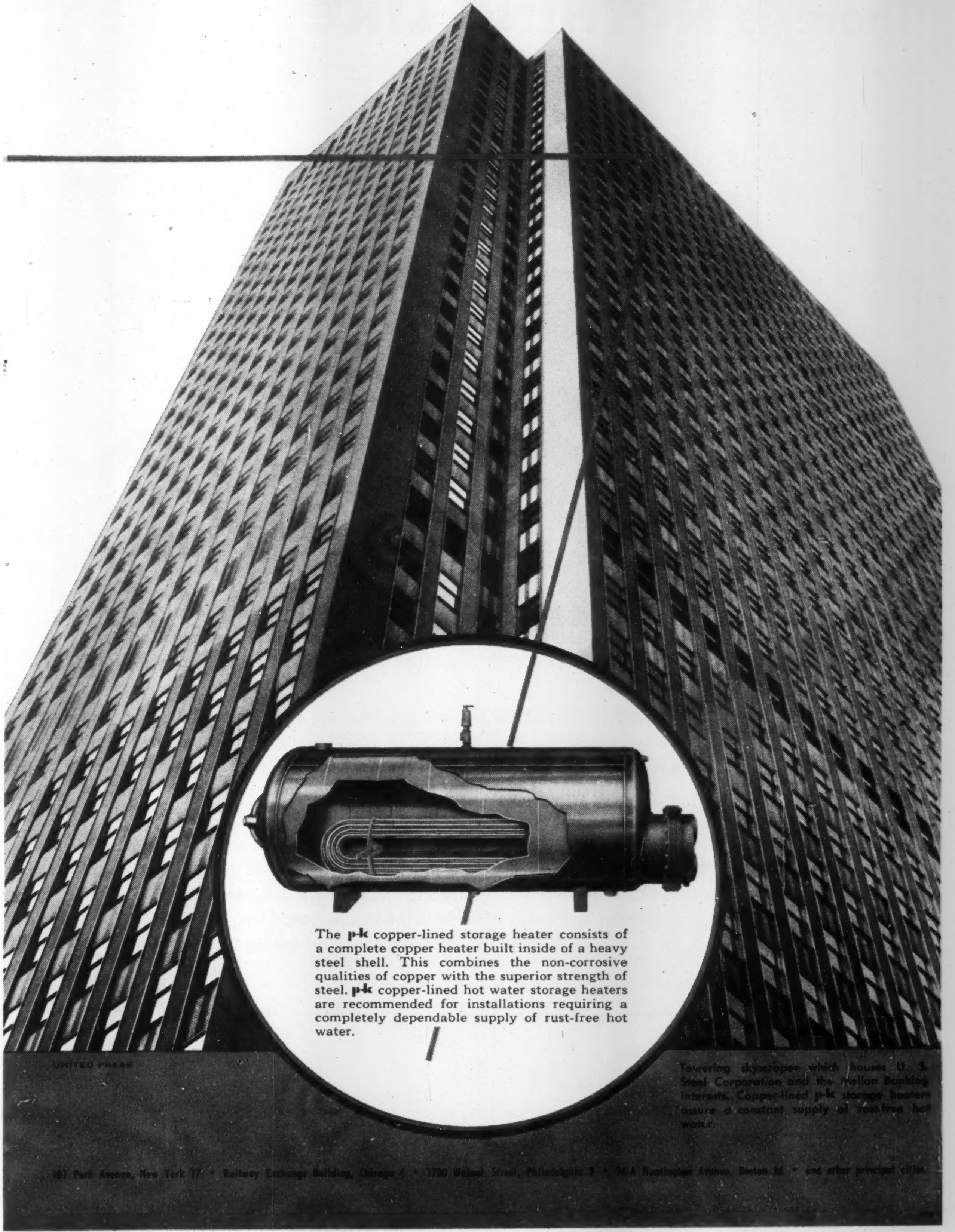
Paul L. Flemm, Building Engineer of the 525 Wm. Penn Place Building, is well satisfied with the operational record of his **p-k** copper-lined hot water heaters.



All of the heaters used in the 525 Wm. Penn Place Building are of the recirculating type with the water going in at 105 deg. F. and out at 140 deg. F. Each has two heating elements; one coil is a condensate cooler which preheats the water with hot condensate; the other uses live steam, as required, to give the desired outlet temperature.

the Patterson-Kelley Co., inc.

790 Burson Street, East Stroudsburg, Penn.



The p·k copper-lined storage heater consists of a complete copper heater built inside of a heavy steel shell. This combines the non-corrosive qualities of copper with the superior strength of steel. p·k copper-lined hot water storage heaters are recommended for installations requiring a completely dependable supply of rust-free hot water.

UNITED PRESS

Towering skyscraper which houses U. S. Steel Corporation and the Mellon Banking interests. Copper-lined p·k storage heaters assure a constant supply of rust-free hot water.

101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities.

There is NOTHING LIKE

Nature's Own Insulation...

There's a Mundet Office near you

ATLANTA, GA.
339 Elizabeth St., N.E.
BALTIMORE 30, MD.
100 S. Charles St.
CINCINNATI 2, OHIO
427 West Fourth St.
DALLAS 10, TEXAS
601 Second Ave.
DETROIT 21, MICH.
14401 Prairie Ave.
HOUSTON 11, TEXAS
6601 Supply Row
P.O. Box 9301
INDIANAPOLIS 3, IND.
1250 Beecher St.
JACKSONVILLE 6, FLA.
800 East Bay St.—Door 44
KANSAS CITY 1, MO.
1210 West 9th St.
LOS ANGELES, CAL.
(Maywood)
6116 Walker Ave.
NEW ORLEANS 16, LA.
315-325 North Front St.
NEW YORK 17, N.Y.
331 Madison Ave.
PHILADELPHIA 39, PA.
856 North 48th St.
ST. LOUIS 9, MO.
3176 Brannon Ave.

In Canada:
Mundet Cork &
Insulation Ltd.
35 Booth Avenue, Toronto

The unique character of Cork is nature-made. Principal qualities required for most efficient low temperature insulation are *inherent* in Cork and have established Cork's reputation for utmost efficiency, economy and long-life.

To Cork's nature-made advantages, Mundet adds careful selection and grading of the raw material . . . to be sure that it is the best quality for the purpose. Mundet then fabricates the Cork into the most serviceable forms for commercial refrigeration, air conditioning and other applications of low temperature.

Modern manufacturing methods are only part of the service that Mundet provides to insure maximum satisfaction from use of Mundet Corkboard and Cork Pipe Covering. Through Mundet contract service, we take full responsibility for the proper installation of our products.
Let us show how our closely integrated service can benefit you.

MUNDET CORK CORPORATION
Insulation Division
7209 Tonnelle Ave., North Bergen, N. J.

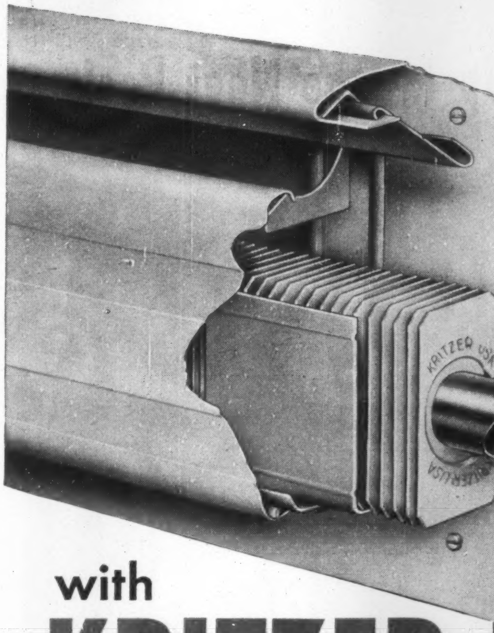
Without obligation, send me your insulation manual, describing Mundet Cork Insulation Products.

NAME...

FIRM...

ADDRESS...

Mundet Insulation Products include: "Custom-Molded 85% Magnesia Pipe Covering, Magnesia Blocks and Segmented Covering for Heat Insulation; High Temperature Pipe Covering and Blocks; "Jointite" Cork Pipe Covering and Corkboard for Low Temperatures.

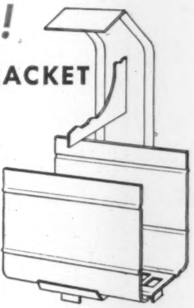


CLEAN HEAT

with KRITZER "K" LINE RADIANT BASEBOARD

makes super-salesmen out of your satisfied customers!

Exclusive Kritzer FEATURE!



COIL SUPPORT BRACKET AND CRADLE

Designed and developed by Kritzer engineers.

Coil cradle fits snugly to fins of the coil to prevent movement in the cradle and damage during operation. Cradle moves with the coil, running smoothly on the ribbed bracket assuring quiet during expansion and contraction of coils in use.

The support bracket is so designed that the face plate of the baseboard snaps firmly to it making a simple, solid assembly.

A survey shows that the cleanliness of radiant baseboard heating leads the list of praises for Kritzer Baseboard: "No dust streaks on the walls", "It doesn't stir up or redistribute the dust in the house", "For the first time we have used light colors for decorating". Next is the clean, crisp lines of the baseboard design which blend with any style of interior. It is easy to keep clean, too.

You will find that the "K" Line is easy to install which means more installations, more satisfied customers, and more profits to you. The "K" Line is made of heavy gauge steel. It will withstand the wear and knocks of an active home giving a lifetime of carefree heating comfort.

The "K" Line is a high quality, low-cost radiant baseboard made for residential and institutional use. For more information write to Kritzer Radiant Coils, Inc., 2901 Lawrence Avenue, Chicago 25.

SEE YOUR JOBBER FOR KRITZER PRODUCTS

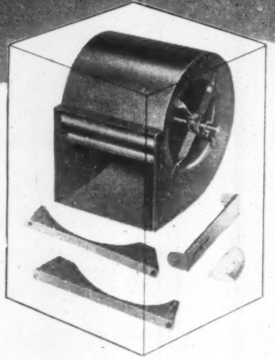
KRITZER BASEBOARD HEATING • KRITZER FIN-PIPE COILS
KRITZER RADIANT PANEL HEATING

KRITZER

IF IT'S KRITZER, IT'S RIGHT, SIR!

This Wraps It Up in One Neat Package!

Brundage UNIVERSAL BLOWERS



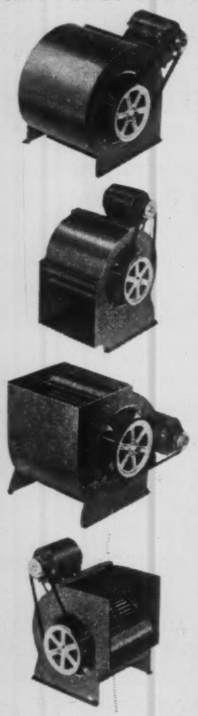
Meets up to 80% of your applications

MEASURE THE DIRECT ADVANTAGES IN YOUR PLANT

SAVE MONEY. Order the blower size you need in larger quantities. Your ordering procedure is simplified and your actual cost per unit is lower.

SAVE TIME. Not only in ordering, but all through your manufacturing operations, you'll find that handling and installation is faster . . . saving time that is actually dollars in your pocket.

CUT YOUR INVENTORIES. You'll free capital that's normally tied up in inventory and stock will require less space. Brundage Universal Blowers pay big dividends at every step of the way.



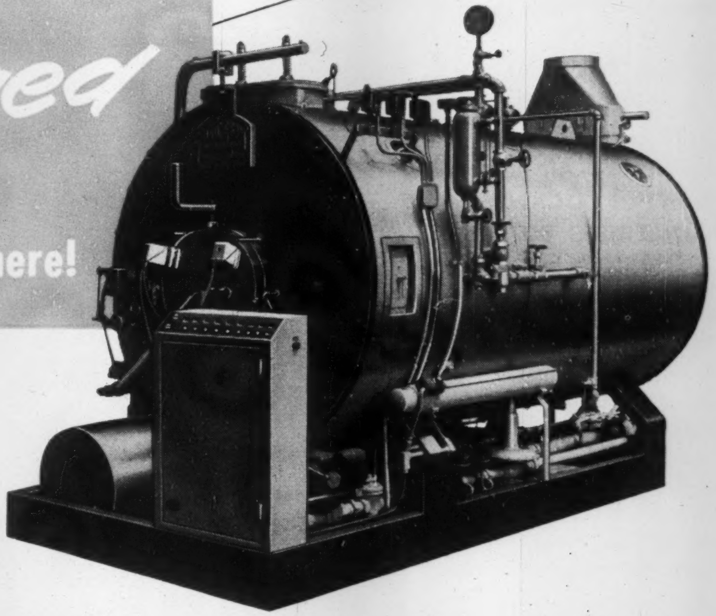
Each Universal Blower provides 8 discharge positions!

YOUR SAMPLE BLOWER is just a phone call away. Ask for the sizes you want and *prove* Brundage superiority to your own satisfaction in your own laboratory.

THE BRUNDAGE COMPANY
North Park St. Kalamazoo, Michigan
Telephone 2-0251

Packaged Heat

—dependable everywhere!

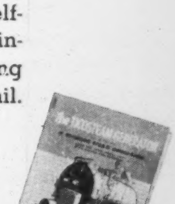


the TITUSVILLE Ticosteam Generator

A complete unit—factory tested, factory certified, conservatively rated, using any fuel oil or gas, or combination—equipped with modern safety features.

The wide range of applications enjoyed by the TICOSTEAM Generator reflects Titusville know-how of more than 90 years in building boilers to meet every trend in demand. This self-contained package unit is completely dependable, easy to install, economical to operate and simple to maintain—meeting modern heating and power requirements to the last detail.

For your copy of informative Bulletin B-3100, write!

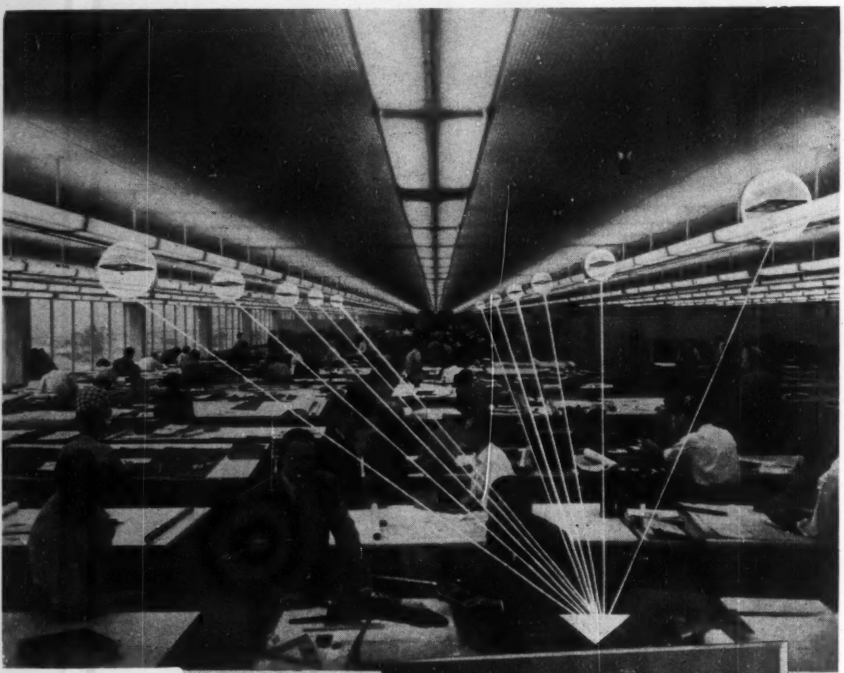


TITUSVILLE
IRON WORKS CO.
TITUSVILLE, PA.

THE TITUSVILLE IRON WORKS COMPANY
TITUSVILLE, PENNSYLVANIA
Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement

A division of **Struthers Wells**

AIR DISTRIBUTION FOR LOCKHEED ENGINEERING BUILDING BY AIR-FACTORS, Inc.



500 'AIR-FACTORS' Model B-60 S&R Diffusers Supply and Return Conditioned Air from ceilings of LOCKHEED ENGINEERING BUILDING

Air-Factors' B-60-S & R diffuser is a single unit combining supply air diffusing qualities with return air features. The combination assembled within a single framework was selected for installation on this job because of its flexibility in sizing, making it possible for the diffusers to be evenly spaced between the channels holding the removable tile ceiling. This resulted in uniformity of design, including the tile pattern and lighting fixtures.

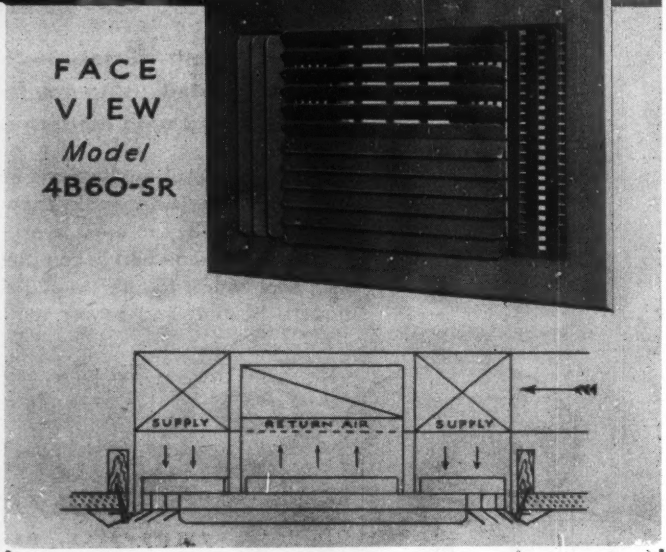
The large areas conditioned required many diffusers. In treating them it was found desirable to remove a proportionate volume of used room air within the length of blow reaches of each supply outlet provided. This design prevented the excessive total air motion caused by uncontrolled mass air movement toward distant exhaust outlets.

Lockheed Engineering Building, Lockheed Air Terminal, Burbank, Calif.

Welton Becket, F.A.I.A. & Associates, Architects

Ralph E. Phillips, Mechanical Engineers

Air Conditioning Company, Inc., Air Conditioning Contractors Southern California

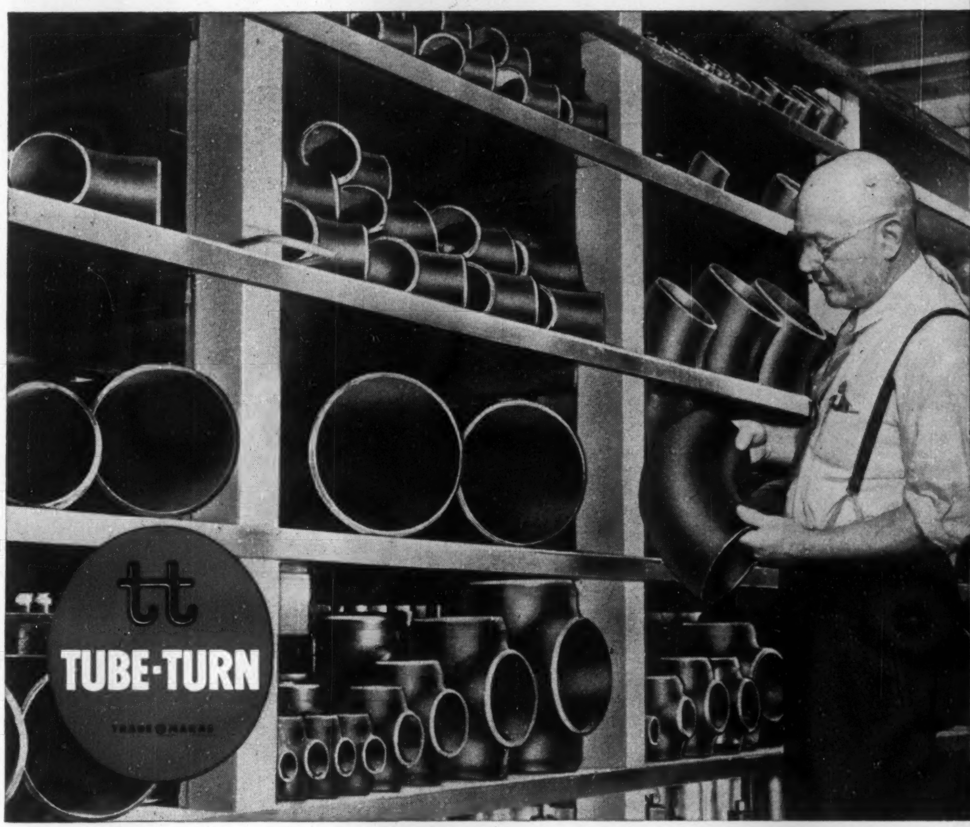


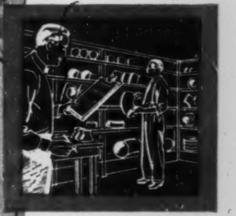
This style outlet is also recommended for use in smaller spaces and individual rooms where building structures prohibit the installation of return or exhaust openings.

B-60-S & R Series is manufactured square or rectangular with 1, 2, 3 or 4-way blow.

A-F
AIR-FACTORS
INC
MONROVIA, CALIFORNIA
AIR DISTRIBUTION
AIR CONTROL

WHY IT PAYS
TO DO BUSINESS
WITH THE
LEADER





Tube Turns' nearby complete stock SAVES YOUR PURCHASING TIME.

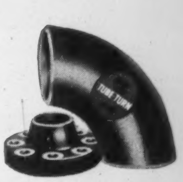
Tube Turns' pioneering research GIVES YOU ADVANCED PRODUCTS.

Tube Turns' engineering help GIVES YOU COST-CUTTING IDEAS.

TUBE TURNS' pioneering research gives you *more for your money*

YOU ARE SURE to get the latest cost-saving developments in fittings and flanges when you specify "TUBE-TURN". Year after year since introducing forged welding fittings in the U. S., Tube Turns has consistently set the pace in research, quality control, development of new types, sizes and materials and in piping engineering.

This product leadership represents another important saving to you when you specify TUBE-TURN Welding Fittings and Flanges. Order them *from your nearby Tube Turns' distributor.* This one reliable source can fill *all* your requirements promptly from the world's most complete line.



"tt" and "TUBE-TURN"
Reg. U.S. Pat. Off.

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Cleveland • Chicago • Denver • Los Angeles
San Francisco • Seattle • Atlanta • Tulsa • Houston • Dallas • Midland, Texas

PRODUCTION
OFFICES
CONFERENCE
ROOM
OFFICES
RECEPTION

HOW TO SPECIFY COOLING
—even on jobs with limited budgets

It's easy—with G.E.'s compact new Packaged Air Conditioners. Here's why! G.E.'s STEP-BY-STEP plan enables your client or customer to cool key areas first. Later, when budget permits, he adds extra G-E packaged units, to cool other areas.

G-E units are priced surprisingly low. Installation costs are low, too. In many applications, no ducts or machinery rooms are required. Space is no problem because there's a G-E unit to fit any situation; so compact it can even be squeezed into corridors and little-used areas.

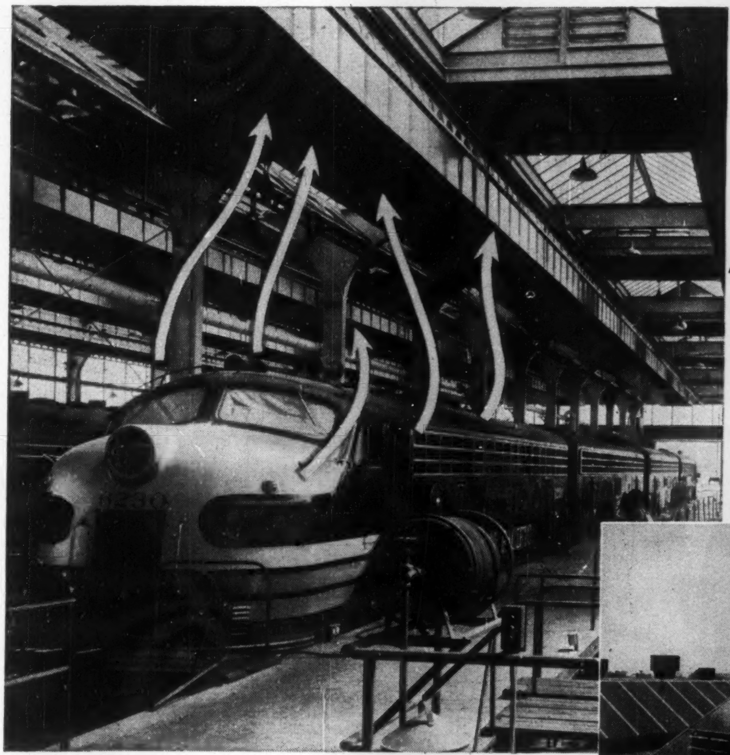
Unprecedented 5-YEAR WARRANTY covers *entire* refrigeration system. Trouble-free, sealed-in cooling unit eliminates need for expensive maintenance crews.

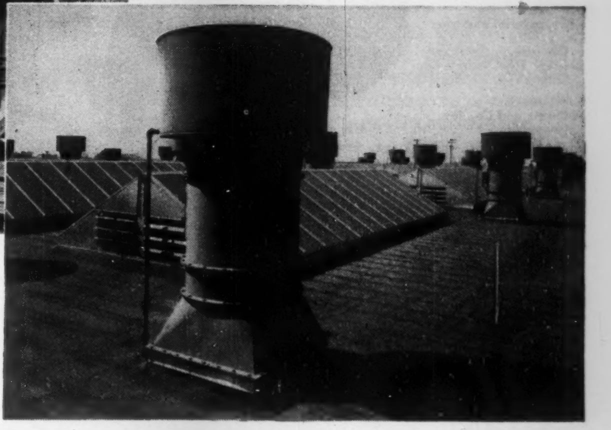
To find out how you can specify G-E Packaged Air Conditioners profitably, write General Electric Co., Sec. HP-9 Air Conditioning Div., Bloomfield, N. J.

GENERAL ELECTRIC

Packaged AIR CONDITIONERS
FOR BUSINESS AND INDUSTRY

DEODORIZING DIESELS





HOW SOUTHERN PACIFIC VENTILATED ITS ROSEVILLE ROUNDHOUSE WITH JOY AXIVANE® FANS

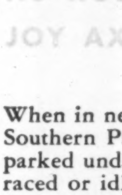
When in need of servicing, the diesel locomotives of Southern Pacific are driven into the roundhouse and parked under long ceiling hoods. As the engines are raced or idled, the customary fumes are emitted from the exhaust. BUT, you have to sniff hard to catch even a faint whiff of diesel fumes in the roundhouse!

HOW'S IT DONE? By Joy Axivane Fans, of course. Thirty-six fans are hidden in the ceiling hoods. The exhaust gases are hustled out—at the rate of 726,000 CFM—before they can contaminate the surrounding air.

TOPS IN EFFICIENCY. Six 1½ HP models handle 11,000 CFM each, while thirty 5 HP models handle 22,000 CFM each. The fans are actually located right in the exhaust ducts—not an inch of valuable room space is sacrificed!

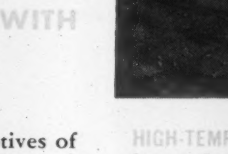
HIGH-TEMPERATURE PROBLEM, TOO. The air being exhausted sometimes reaches a temperature of 280° F., but temperature variations have little effect on these fans. The vaneaxial design, with adjustable blades, packs plenty of punch—under all conditions. The in-line construction and in-the-duct installation . . . possible only with this type of fan . . . make for real space savings.

136 MODELS. The Joy Axivane Fan line is a wide one. Capacities range up to 200,000 CFM and pressures top 11″ wg. Some models will nestle in the palm of your hand while others would dwarf your home. Want the whole story? Write for our Bulletin J-611, TODAY. **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.,** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*



Consult a Joy Engineer, or

WRITE FOR THIS BOOKLET #J-611



W&D I-4875

JOY

SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885

Easiest way to get REPUBLIC Stainless Steel Pipe

ALABAMA
Industrial Piping Supply Corp.
Bessemer

CALIFORNIA
Ducommun Metals & Supply Co.
Los Angeles
Tayler & Spotswood Co.
San Francisco

GEORGIA
Atlantic Steel Co
Atlanta

ILLINOIS
Chicago Tube and Iron Co.
Chicago
Chicago Steel Service Co.
Chicago

KENTUCKY
Williams and Co., Inc.
Louisville

MARYLAND
The Hill-Chase Steel Co. of Maryland, Baltimore

MASSACHUSETTS
A. C. Harvey Co.
Boston

MICHIGAN
Kenneth Anderson Co.
Detroit

NEW JERSEY
A. B. Murray Co., Inc.
Elizabeth

NEW YORK
W. A. Case & Sons Mfg. Co.
Buffalo

OHIO
Hamilton Steel Co.
Cleveland
Williams & Co., Inc.
Cincinnati
Williams and Co., Inc.
Cleveland
Williams and Co., Inc.
Columbus
Williams and Co., Inc.
Toledo

PENNSYLVANIA
Hill-Chase & Co., Inc.
Philadelphia
Williams and Co., Inc.
Pittsburgh

TENNESSEE
Metals, Inc.,
Bristol
Siskin Steel & Supply Co.
Chattanooga
Vance Iron and Steel Co.
Chattanooga

TEXAS
Earle M. Jorgenson Co.
Houston

VIRGINIA
John Frishchkorn
Richmond
Mize Supply Co.
Waynesboro

American Radiator & Standard Sanitary Corp. in many leading cities

Creamery Package Co. (Sanitary Applications) in many leading cities

Just pick up the phone and call your nearest Republic distributor. He'll ship the sizes you need, in the analyses the job calls for.

The ELECTRUNITE Stainless Steel Pipe or tubing he gets for you is stenciled for positive identification before it's used. And no matter where it's cut, it can still be identified.

Remember, too, it doesn't matter how the pipe or tubing have to be joined. Republic ELECTRUNITE Stainless Steel Pipe can be welded, threaded or used with compression fittings. And you can have it in types 304, 304-L, 316, 316-L, 321 and 347 along with other analyses.

Sizes from ⅛" I.P.S. through 2" I.P.S. in A.S.A. schedule 40S; from ⅛" I.P.S. through 4" I.P.S. in schedule 10S; and from ½" I.P.S. through 4" I.P.S. in schedule 5S wall thicknesses. You can also get Republic Stainless Steel Tubing in a complete range of sizes and analyses.

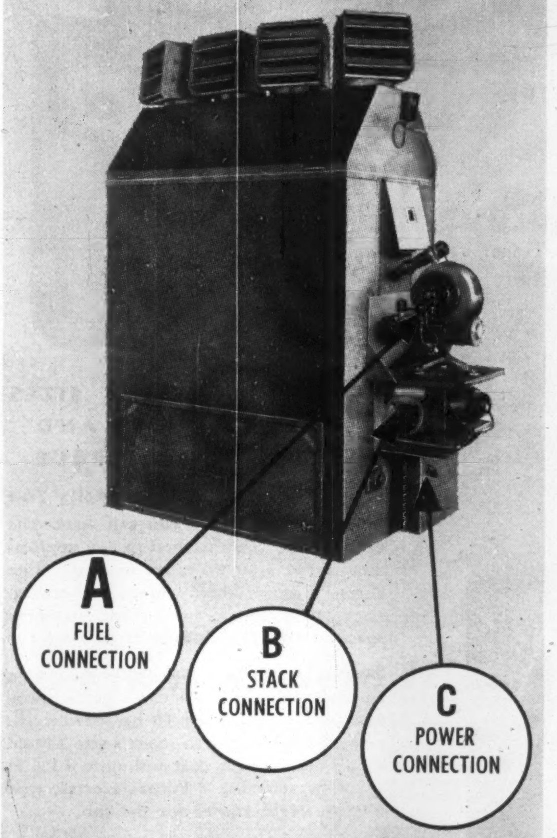
Don't waste time tracking down the stainless steel pipe or tubing you need. Just pick up the phone and call your Republic distributor. He's a good man to do business with. And he's always willing to help you.

REPUBLIC STEEL CORPORATION
Steel and Tubes Division
231 E. 131st Street, Cleveland 8, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

REPUBLIC ELECTRUNITE
REPUBLIC STEEL
STAINLESS STEEL TUBING AND PIPE

REPUBLIC ELECTRUNITE ® STAINLESS TYPE 304 HEAT#78910 SPEC-A-312

INSTALLATION easy as A-B-C



THREE SIMPLE STEPS —

An Olson installation requires only the connection of fuel supply, connection to power line, connection to exhaust stack and it's ready for automatic operation — unattended. A self-contained stainless steel combustion chamber eliminates the costly, time-consuming task of refractory lining. Greatest of all, the initial cost is so much lower than other types of heating.

These attractive installation features are made possible because Olson Heaters are completely factory-assembled by the same expert craftsmen who build them. It comes to you as a complete self-contained unit, pre-flame-tested, pre-regulated, ready to start a long life of smooth heating service for its owner.

SEPARATE DRAFT FAN

. . . . . . Eliminates objectionable cold air blast at every start. Personnel directors say this extra feature is especially appreciated by employees.

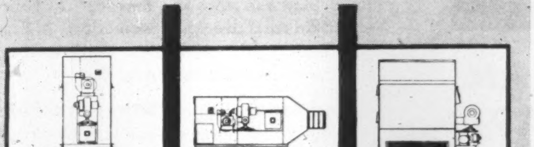
RUGGED CONSTRUCTION

Rigid base, free from vibration, low fan speed, oversize drive, heavy shaft, large self-aligning ball bearings, heavy outside casing with radiation shield and ample relief and access doors.

ALL POPULAR PARTS

All accessories on Olson Heaters are of the best name and quality known to heating engineers. They are standard products of nationally known manufacturers. Replacements are available anywhere.

WRITE FOR BULLETIN A1 A—DETAILED, ILLUSTRATED



Olson Heaters are available in many models and wide variation of applications of make up air, drying, high temperature and process work. Capacities range from 300,000 to 7,500,000 B.T.U. per hour.

Olson

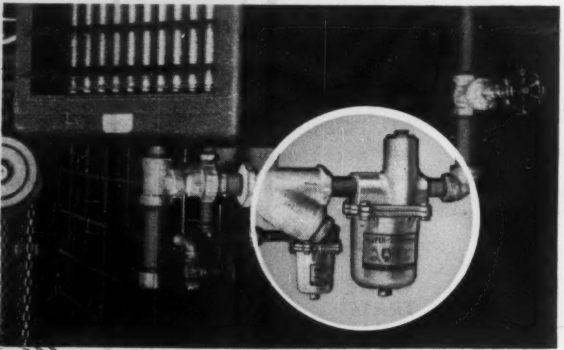
ARTHUR A. OLSON & CO., CANFIELD, OHIO
REPRESENTATIVES IN PRINCIPAL CITIES

HEATERS FOR GAS, OIL, COAL OR DUAL GAS AND OIL

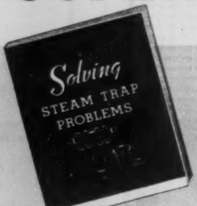
BRING Florida Weather

IN YOUR PLANT THIS WINTER

- You'll be just as comfortable in your factory, warehouse, or office building this winter as you would be in Florida, if you will follow this simple suggestion. Put fast-venting Heat-Kwik Super-Silvertop Steam Traps on every unit heater. Super-Silvertop Heat-Kwiks bring unit heaters up to maximum heat output in 2½ minutes—save hundreds of dollars by letting you turn on steam as much as a half hour later every morning. Man-sized Super-Silvertop *inverted bucket* traps succeed when thermostatic or orifice type traps fail because they alone discharge high temperature condensate, and operate at low pressure differentials. Use them on unit heaters to keep your plant warm, reduce unit heater corrosion, and to save on fuel bills. See your jobber today!



SUPER-SILVERTOP STEAM TRAPS



FREE!

This 36-page book shows how to select the proper sized trap for unit heaters and other steam applications.

THE V. D. ANDERSON COMPANY
Subsidiary Chesapeake Industries
1949 West 96th Street • Cleveland 2, Ohio
Gentlemen: Please send me the following:
36-page book "Solving Steam Trap Problems"

Name____________________ Title__________

Company ________________________

Address ________________________

City____________________ State__________

FURNAS ELECTRIC

Magnetic Starters

Your most complete selection in the 1-50 hp range

NEW "IN-BETWEEN" SIZES SAVE ON COSTS AND UP TO 40% IN SPACE

Why Pay for Starter Capacity You Never Use? Now you can select the exact starter size matched to any application in the 1-50 hp range from the nine Furnas Electric sizes. Many in-between sizes can save you money and conserve space. Immediate delivery from stock.

Same Service, Less Money—Here's an example of how you can save: Suppose you want a starter for 10 hp service. It's no longer necessary to select a size 2 rated 25 hp. You save in cost and up to 40% in space by selecting a Furnas Electric type YE, the right starter for the job.

Important Features—1. Dual voltage coils matched to your motor. 2. Four-speed thermal overload protection. 3. Easy installation and wiring in shallow case. 4. Heavy contacts for long life.

Complete Range of Other Products—Pressure switches for air and water applications. Drum controllers for reversing, multi-speed and reversing multi-speed service.

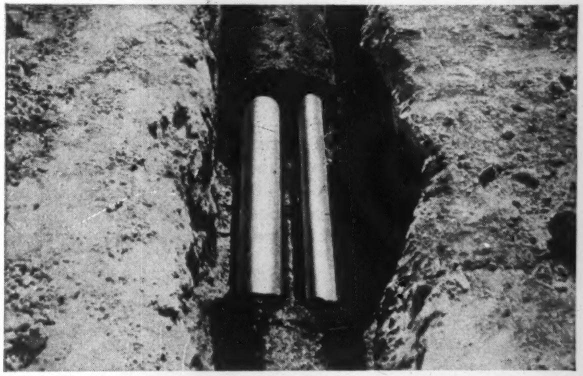
Write today for Bulletin No. 5402, giving the full story. Furnas Electric Company, 1041 McKee Street, Batavia, Illinois.

FURNAS ELECTRIC
Batavia, Illinois

3 Big Reasons Why

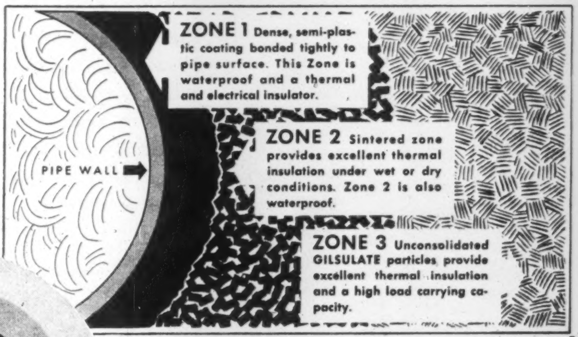
1. GILSULATE—Easy to install—Just pour it on, tamp it down and backfill. Run heat through the pipes (up to 520°F)...and the job is completed. No need to remove rocks from backfill; no problems of cramped space or multiple piping.

more and more hot underground pipe gets insulated



2. GILSULATE—Cost Less per Installed Linear Foot—No skilled labor needed...requires no mechanical sheaths, special protective devices, or costly installation procedures.

with new modern triple-zone GILSULATE®


ZONE 1 Dense, semi-plastic coating bonded tightly to pipe surface. This Zone is waterproof and a thermal and electrical insulator.
ZONE 2 Sintered zone provides excellent thermal insulation under wet or dry conditions. Zone 2 is also waterproof.
PIPE WALL
ZONE 3 Unconsolidated GILSULATE particles provide excellent thermal insulation and a high load carrying capacity.

3. GILSULATE—Delivers Permanent Triple-Zone Protection— Three tough, massive circular sheaths completely and permanently protect the pipe, cut heat loss down to 8% to 11% of bare buried pipe. Triple-zone protects against all buried line corrosion conditions: water, roots, acid, alkalis, bacteria, etc.

Fill in coupon for complete details.

GILSULATE®

THE TRIPLE-ZONE INSULATION
FOR LIFETIME PROTECTION
OF HOT UNDERGROUND PIPES

AMERICAN GILSONITE COMPANY, SALT LAKE CITY, UTAH
Affiliate of Barber Oil Corporation and Standard Oil Company of California
Distributors in principal cities of United States and Canada

American Gilsonite Company
134 West Broadway
Salt Lake City, Utah

Please send me further information on GILSULATE

NAME..

TITLE..

COMPANY..

ADDRESS..

HPC

NOW!

A BRAND NEW ADDITION TO THE FAMOUS CARNES QUALITY LINE

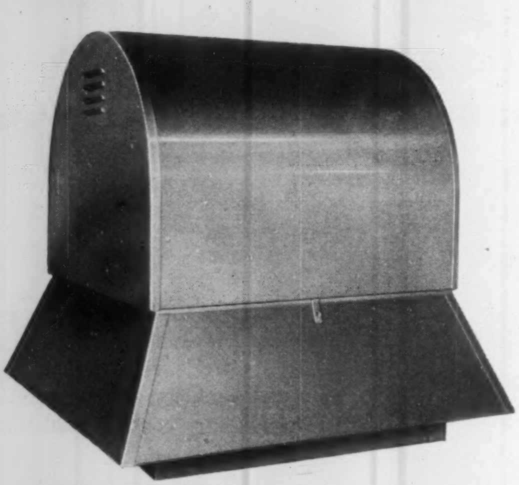
POWER ROOF VENTILATOR

CARNES

NEW MODEL B

CENTRIFUGAL

- QUIET OPERATION
- PROTECTED MOTORS
- MAXIMUM CAPACITY



Here's the latest in famous Carnes Power Roof Ventilators . . . the new Model B with centrifugal fan wheel. Ruggedly constructed for years and years of trouble-free service, and with these outstanding features: Belt-driven for greater flexibility of fan speed; motors are mounted on vibration eliminators; low silhouette; aluminum housings are standard, also galvanized copper or stainless steel; hinged motor hood; large capacity, precision-built fan wheels balanced both statically and dynamically. Write today for literature, prices and complete information.

Sizes — 15″ through 60″ wheel

Capacities — 2,000 to 50,000 C.F.M.

PLUS... THESE OUTSTANDING MODELS

MODEL CL

CENTRIFUGAL

A modernly designed centrifugal type ventilator that features all aluminum construction; quiet operation; low silhouette; heavy duty, ball-bearing, protected motors; maximum capacity; precision-balanced fan wheels.

Sizes — 4″ through 24″

Capacities— 200 to 7500 C.F.M.

MODEL AX

AXIAL FLOW

Identical modern design as Model CL, but equipped with axial flow fan. Exceptionally quiet in operation, and with all the same quality construction features that are provided in the CL.

Sizes — 10″, 12″ and 16″

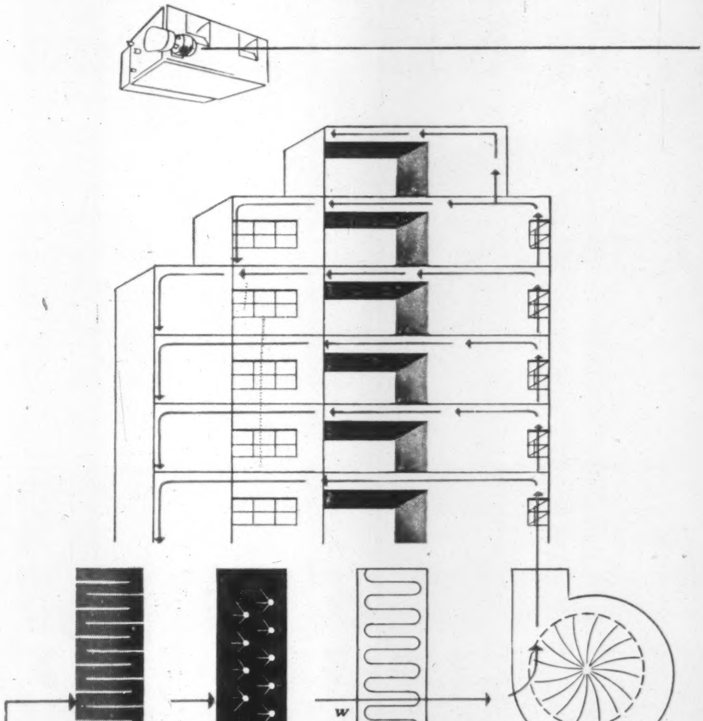
Capacities— 550 to 2500 C.F.M.

CARNES The Most Talked About Name in Air Distribution

W. R. CARNES CO., VERONA, WISCONSIN

THE MARK OF
EXTRA DEPENDABLE
REFRIGERATION AND
AIR CONDITIONING EQUIPMENT

ED
ELECTRO DYNAMIC



The red "power spot" on refrigeration or air conditioning equipment means *powered by Electro Dynamic,* the most dependable motors *ever* available to industry.

For *proof* of this *extra dependability* send the coupon below for your copy of **"MOTOR SHOWDOWN"**, a new candid report on comparative results of motor performance tests* conducted in accordance with A. I. E. E. standards.

*Tests certified by J. Arthur Balmford, Professor of Electrical Engineering at a leading Eastern University.

1 to 250 hp., AC and DC
N. E. M. A. standard frames
All types of enclosures

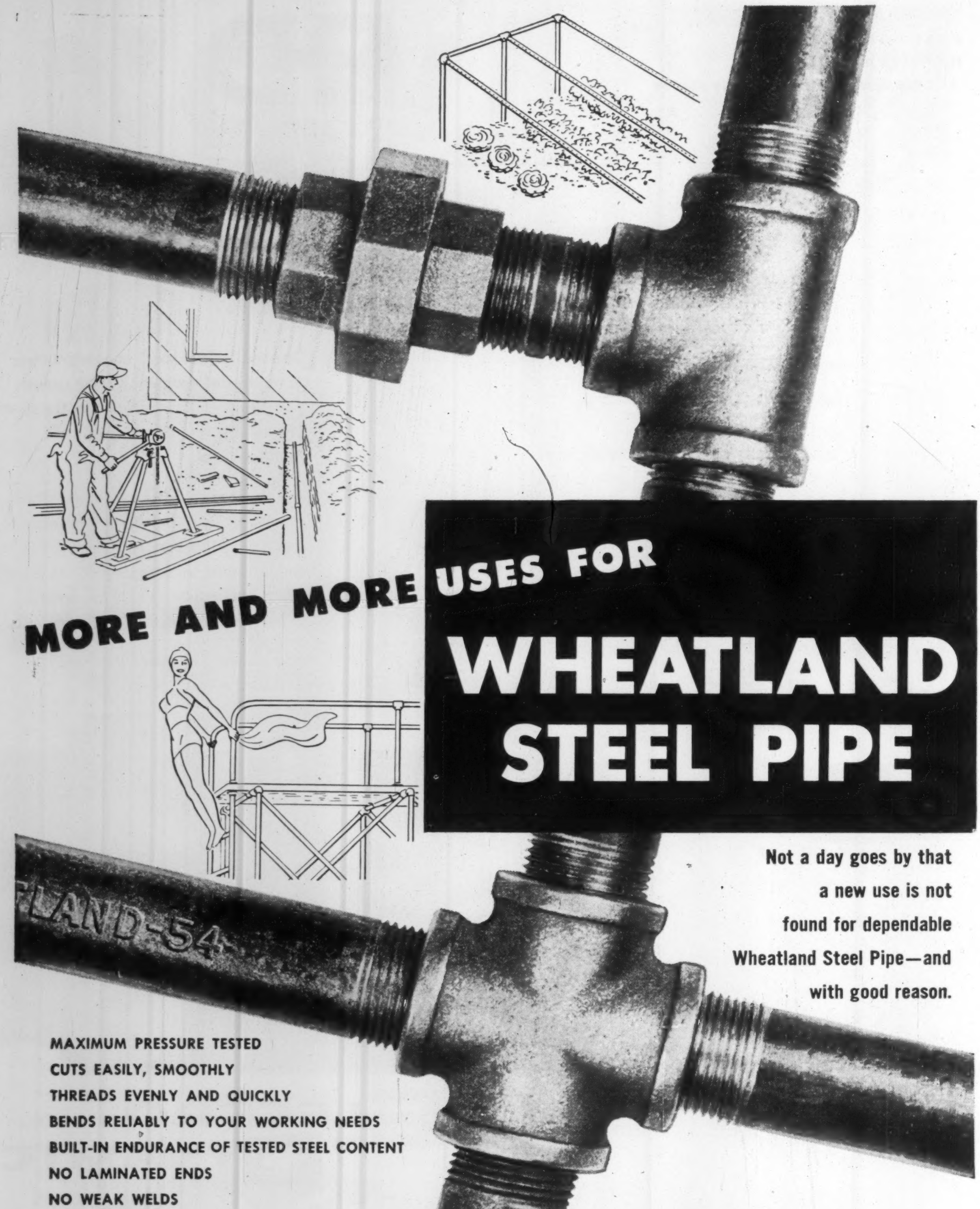
ELECTRO
Extra DYNAMIC
Dependable motors

ELECTRO DYNAMIC
Division of General Dynamics Corporation
150 Avenue A, Bayonne, New Jersey

ED
ELECTRO DYNAMIC
MOTOR
SHOWDOWN

Please send me a copy of "MOTOR SHOWDOWN" and the new catalog of Electro Dynamic industrial motors.

NAME____________________
COMPANY____________________
ADDRESS____________________
____



MORE AND MORE USES FOR WHEATLAND STEEL PIPE

Not a day goes by that a new use is not found for dependable Wheatland Steel Pipe—and with good reason.

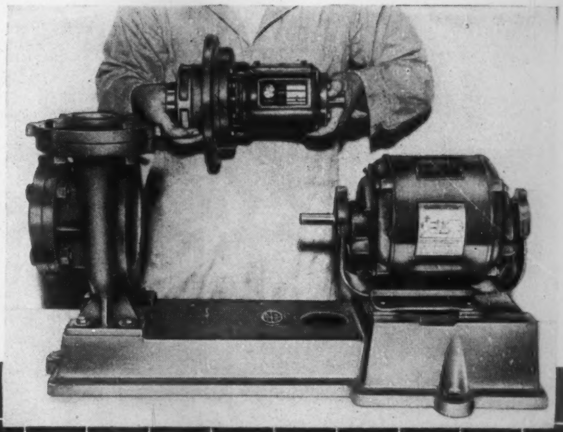
- MAXIMUM PRESSURE TESTED
- CUTS EASILY, SMOOTHLY
- THREADS EVENLY AND QUICKLY
- BENDS RELIABLY TO YOUR WORKING NEEDS
- BUILT-IN ENDURANCE OF TESTED STEEL CONTENT
- NO LAMINATED ENDS
- NO WEAK WELDS
- PROMPT DELIVERY

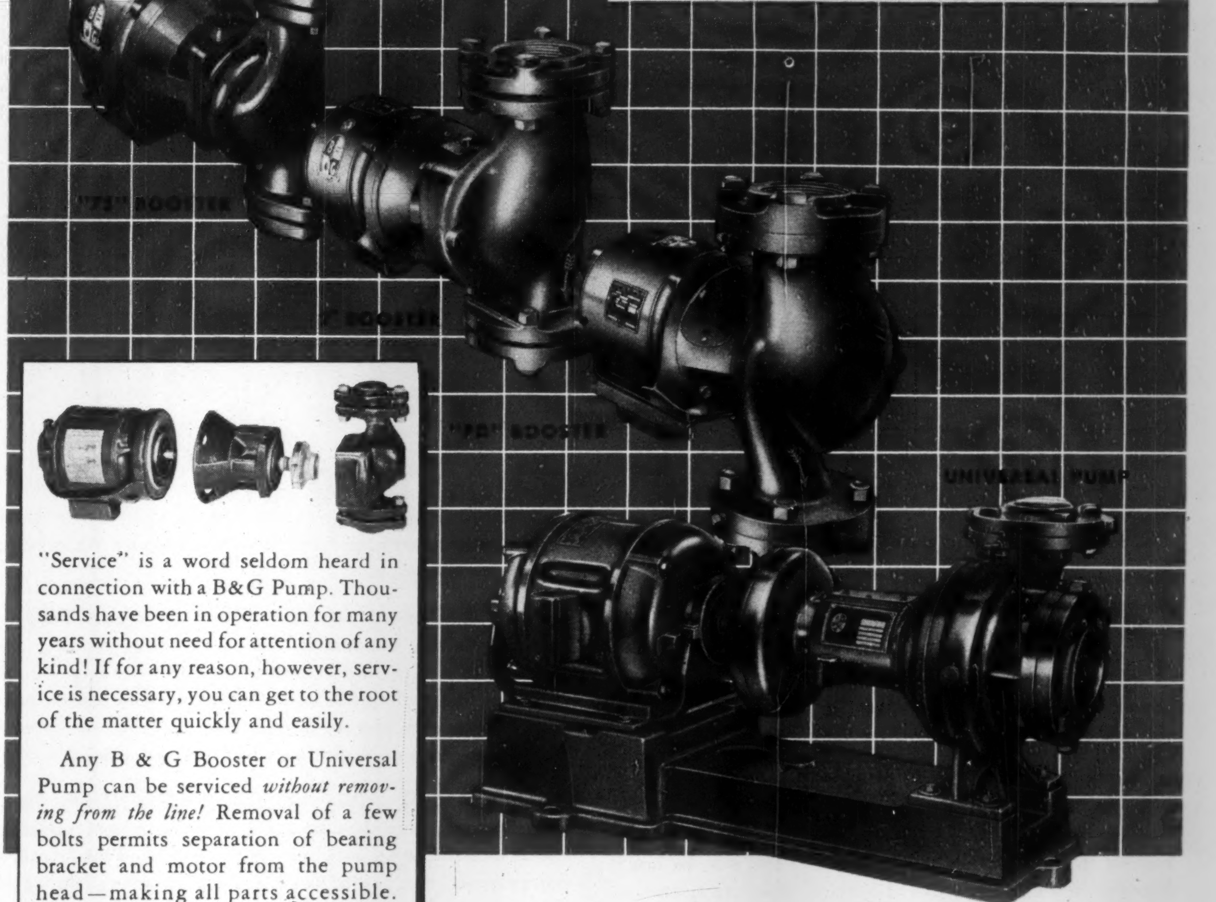
Discover yourself the integrity of dealing with Wheatland, makers of the famous "pipe with the year mark"—mark your next order Wheatland Steel Pipe.

WHEATLAND
TUBE COMPANY
Bankers Securities Building Philadelphia 7, Penna.

B&G PUMPS ARE *EASIER TO SERVICE*

(BUT SELDOM NEED IT)





"Service" is a word seldom heard in connection with a B&G Pump. Thousands have been in operation for many years without need for attention of any kind! If for any reason, however, service is necessary, you can get to the root of the matter quickly and easily.

Any B & G Booster or Universal Pump can be serviced *without removing from the line!* Removal of a few bolts permits separation of bearing bracket and motor from the pump head—making all parts accessible. Precision manufacturing methods assure positive accuracy of fit and complete interchange of parts between pumps of the same size.

In every detail, B & G Pumps are constructed to (1) operate *quietly*, (2) perform *dependably* and (3) last for *years!* That's why more are sold than any other pump built for the same purpose.

THE MOST COMPLETE LINE OF PUMPS DESIGNED SPECIFICALLY FOR FORCED HOT WATER HEATING SYSTEMS

BELL & GOSSETT
COMPANY
Dept. DO-5, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

"Take this man I'm going to see"

"Hi, Ed. Shining up for a date?"

"Sure enough, Jim. An important one, too. I'm calling on a new prospect. He's going into a new product and I'm sure he can use our fabrication facilities!"

"I thought you fellows at Wolverine only made tubing. I didn't know that you were set up to fabricate. Never thought of you as that type of source!"

"Fabrication is one of the things we specialize in, Jim. We're equipped to do just about anything to make a tubular part. Take this man I'm going to see, for example. This part he's making starts out as a sheet of copper. The way he has it figured out, it's going to take about eight separate operations to complete the part."

"But with Wolverine's Spun End Process* we can start out with a length of copper tube and in one operation we'll end up with the complete part. We do it by spinning the tube in special dies and the die gives it the desired shape. It'll give him a one-piece part—cut his costs in half."

"Say that sounds terrific. Our engineering department will be all ears when I tell them about this. I'm sure this spinning deal can help us, too."

"That's only part of it, Jim. We also do special bending, coiling, flaring, expanding, finning, swaging, piercing and drilling as well as soldering, brazing and threading. Add to this the fact that besides copper, we work in copper-base alloys, aluminum and electric-welded steel and you have a quick run-down of Wolverine's fabricating facilities."

ALL-IN-ALL IT ADDS UP TO TUBEMANSHIP. That's Wolverine's word for the type of thinking that combines tube manufacturing with fabrication. You'll find the complete story as well as a host of new ideas in Wolverine's Fabricated Parts Book. Write for your copy today. WOLVERINE TUBE, Division of Calumet & Hecla, Inc., 1461 Central Avenue, Detroit 9, Michigan.

*PATENTED PROCESS RE. 22465

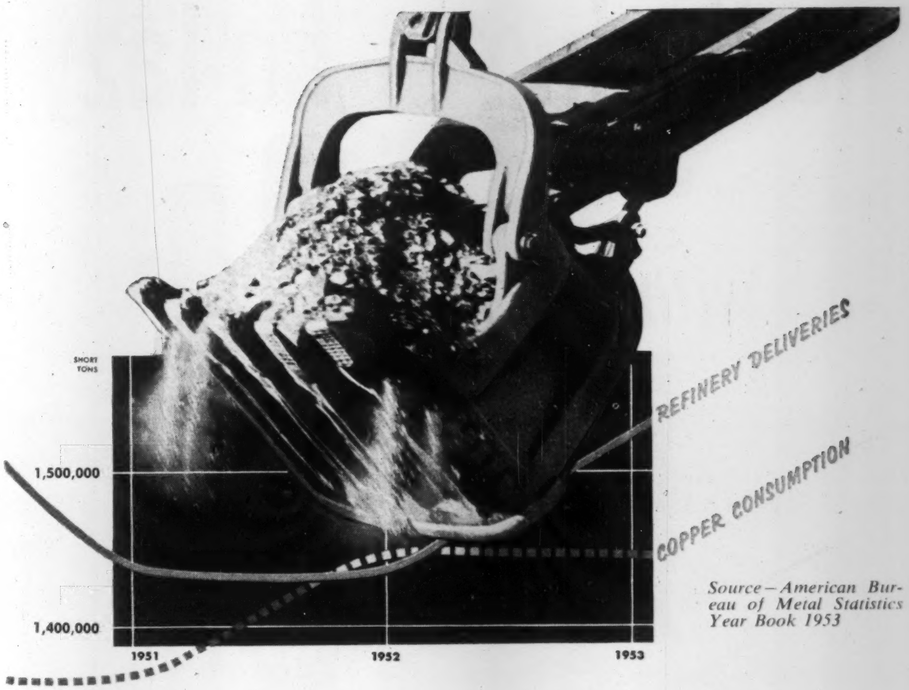
EST. 1916

WOLVERINE TUBE
DIVISION OF CALUMET & HECLA, INC.

Manufacturers of Quality-Controlled Tubing

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

EXPORT DEPARTMENT, 13 EAST 40TH STREET, NEW YORK 16, N. Y.



Source—American Bureau of Metal Statistics Year Book 1953

Plenty of Copper... today and tomorrow

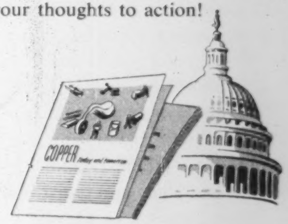
The assurance that copper is in abundant supply and *can be used without restrictions* is the "go ahead" for industry. You can now rate PERFORMANCE over AVAILABILITY when choosing materials. By using copper and its alloys, brass and bronze, your product is easier to fabricate, better and more durable.

We can get more copper than we now have. Although industry and government have been consuming more copper than in any previous peacetime period, production has kept pace with this increased demand. And producers are not working at full capacity!

More copper keeps on coming. Eleven major new projects in the U. S. will start producing in the next 3 years. These mines will add 250,000 tons to our annual production—more than *¼ of all the domestic copper mined during 1953*. In addition, recent improvements in mining techniques now make it possible to obtain copper from ores considered commercially unworkable in the past.

Copper is virtually indestructible. At least 3 out of every 4 pounds of copper used in today's products, when scrapped, can be re-used in the future. Every day we are adding to our "copper capital". The more copper we use . . . the more we have!

Copper has a new ability to serve you. Many of your problems are being solved in the laboratories of the copper and brass industry. Whether it's a new alloy, a different temper or a special property . . . copper can help you develop new ideas. Copper can bring old methods up to date. Call a supplier of copper and brass and convert your thoughts to action!



* ***"Copper . . . is fortunately available in ample supply to meet any foreseeable demand"***
Foreword, U. S. Dept. of Commerce
B.D.S.A. Copper Quarterly, August 1954

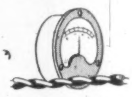
For information about U. S. copper supplies including free copies of this Government report and the new booklet, "Copper . . . Today and Tomorrow", send attached coupon to:

Copper & Brass Research Assn., Dpt. GG
420 Lexington Ave., New York 17, N. Y.

NAME ....
COMPANY ....
ADDRESS ....
CITY .... STATE ....

COPPER & BRASS Research Association

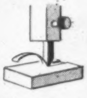
Copper or its alloys provide these advantages . . .



Best conductor of electricity commercially available.

Does not rust . . . high corrosion resistance.

Best heat transfer agent of all commercial metals.



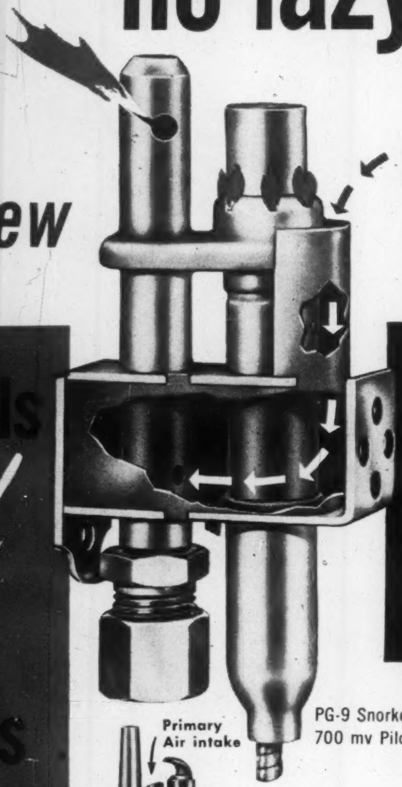
Easy to machine, form, draw, stamp, polish, plate, etc.

Welds readily . . . excellent for soldering and brazing.

no linting no lazy flame

with the new

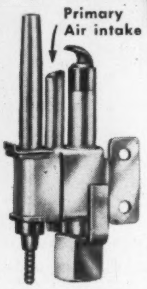
General Controls *Snorkel* type Blue Flame Pilot Generators & Pilot Burners



PG-9 Snorkel
700 mv Pilot Generator

POSITIVE INCINERATOR PRINCIPLE . . .

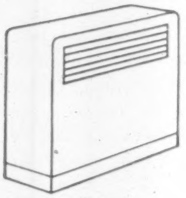
DIRT-FREE PRIMARY AIR THROUGH SNORKEL INSURES BLUE FLAME PILOT STABILITY ON ALL GAS-FIRED APPLIANCES



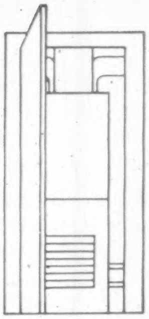
26S Pilot Burner

Primary
Air intake

260S Pilot Burner

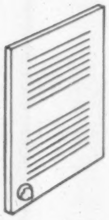


CONSOLE HEATER

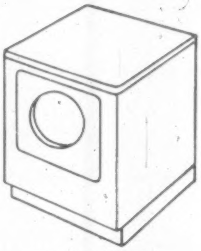


CLOSET HEATER

IDEAL FOR ABOVE-THE-FLOOR INSTALLATIONS



WALL HEATER



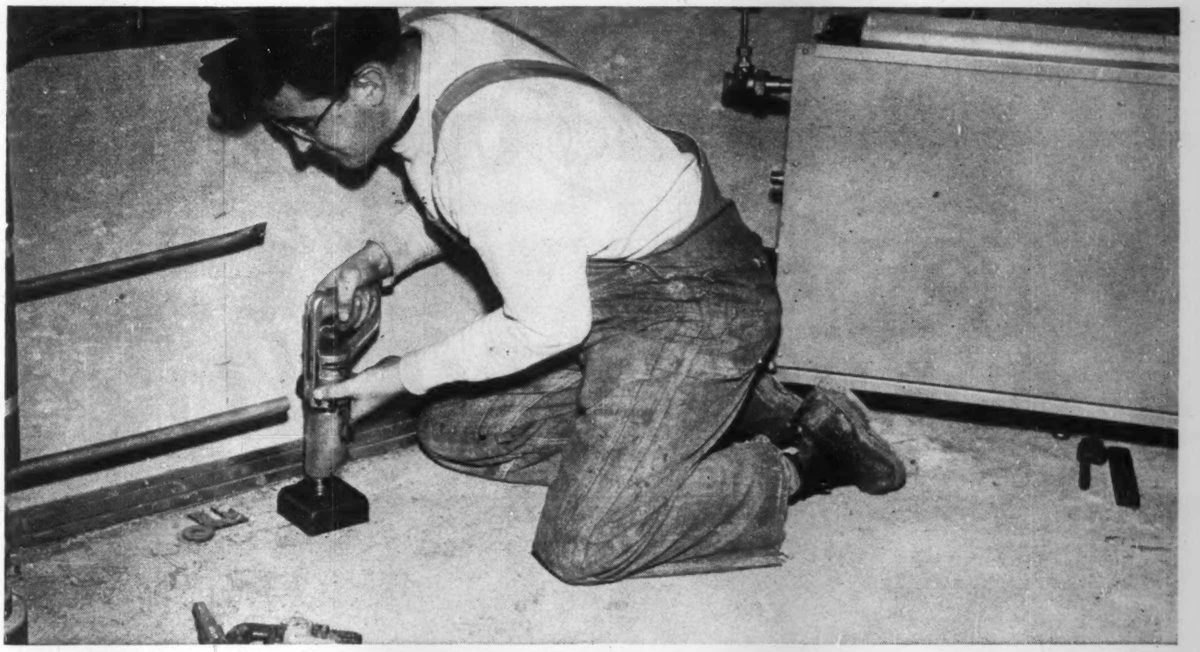
CLOTHES DRYER

General Controls' Snorkel Pilot Burners and Pilot Generators incorporate proven design principle. The primary air passes under pilot flame which incinerates dirt and lint. Elimination of these foreign particles insures a crisp and stable blue flame. Primary air is mixed with gas at pilot orifice in a sealed mixing chamber which is cool, thus preventing cracking of the gas. Pilot and thermopilot flame ports are large diameter to prevent plugging. PG-9 Snorkel Pilot Generators, 260S and 26S Pilot Burners are available for all General Controls thermocouple-operated safety and self-powered control systems.

GENERAL CONTROLS

PLANTS IN: GLENDALE, CALIF., BURBANK, CALIF., SKOKIE, ILL.
FACTORY BRANCHES IN 37 PRINCIPAL CITIES
SEE YOUR CLASSIFIED TELEPHONE DIRECTORY

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls for Heating, Home Appliances, Refrigeration, Industrial and Aircraft Applications.



Cut fastening costs up to 80% on heating and air conditioning installations...with the

REMINGTON STUD DRIVER

"It saves us money on every fixture we install"—that's the kind of report we're getting every day on the Remington Stud Driver. Big savings just naturally result from the amazing speed of this powder-actuated tool. It sets as many as 5 studs a minute in steel or concrete!

You'll find real economy, too, in the fact that the Stud Driver is completely self-powered—no need for extra equipment, wires or cables. Compact and portable, the tool is designed in every way for easy handling. And since it weighs only 6 pounds, it's ideal for working overhead and in confined spaces.

What's your fastening job? Whether it's fastening pipe to walls and ceilings or anchoring fixtures to concrete floors, you'll save money with the Remington Stud Driver. For complete information on how to cut *your* fastening costs, just send in the coupon below.

QUESTIONS YOU ARE ASKING

QUESTION:

What are the studs made of?

ANSWER:

Genuine Remington studs are made of a selected molybdenum-bearing alloy steel, heat-treated for required hardness and ductility properties. All are plated for protection against corrosion.

"If It's Remington—It's Right"

UL

Remington DU PONT

Listed & Approved by Underwriters' Laboratories, Inc.

MAIL THIS COUPON TODAY

REMINGTON
STUD DRIVER

Industrial Sales Division, Dept. HPAC-9
Remington Arms Company, Inc.
Bridgeport 2, Connecticut

Please send me free copies of the new booklets showing how I can cut my fastening costs.

*Name*______________________________________

*Position*____________________________________

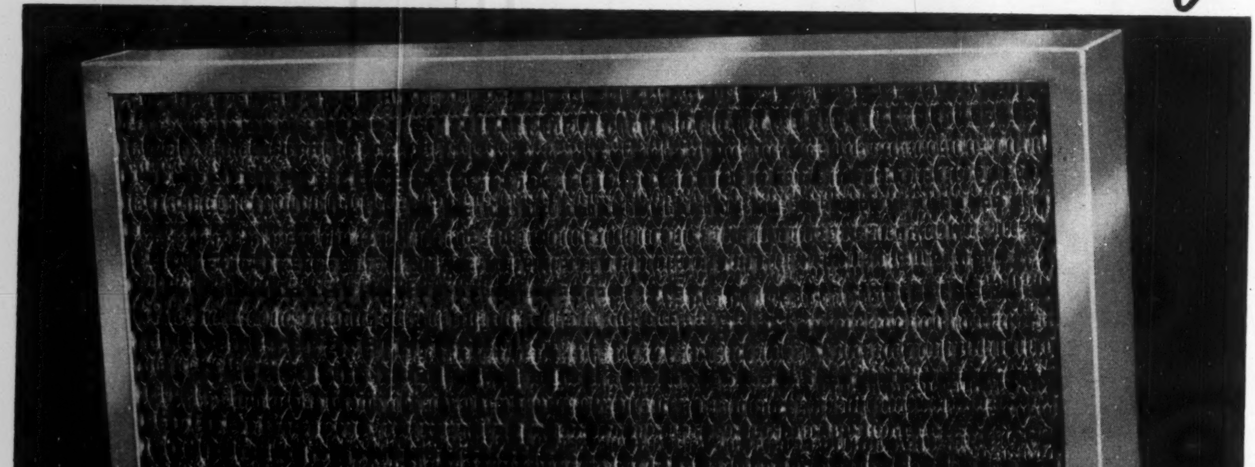
*Firm*______________________________________

*Address*___________________________________

*City*________________________ *State*____________

Evans

Completely Lifelong



New All Aluminum

AIR FILTER

OPENING AN AMAZING NEW FIELD IN SALES AND PROFITS . . . . PLUS

Guaranteed Territory Protection

Revolutionary New Design!

Filter pack contains a series of machine stamped, all aluminum grids. Every grid precision made for absolutely *exact size openings . . . exact measured corrugations* . . . to produce precision filtering of air. Burr edge on every opening gives extra filtering efficiency. Top aluminum stamped grid designed has larger openings to prevent matting of lint. The FIRST all aluminum filter with every part *originally created for filtering of air only.*

Revolutionary New Performance!

Less resistance to air flow than ever thought possible. More controlled turbulence to trap dust. Air must travel more than double the thickness of filter from inlet side to outlet side. Every side and angle of filter grid scientifically designed to present more area and sharper edges for gathering and holding dust. *Lower resistance to air flow permits greater coil efficiency than heretofore thought possible.* Saves fuel. Filters last a lifetime. Used dry or with oil. Can be *cleaned* "clean" in a few minutes with hot water and used over and over again for years and years.

Greater Profits Per Unit!

The Evans Merchandising Policy is something completely new. It protects distributors, jobbers and dealers on sales. In fact it GUARANTEES this protection. If you are now handling an old-fashioned line of filters which is not giving you adequate profits, adequate customer satisfaction and adequate territory protection, then by all means get the complete Evans story on both this new lifetime filter and the new Merchandising Policy. It positively has no equal.

INVESTIGATE NOW! MAIL THIS COUPON TODAY!

THE GEORGE EVANS CORPORATION, MOLINE, ILLINOIS

GENTLEMEN: Please send me: ☐ **Descriptive Literature** ☐ **Merchandising Policy** ☐ **Price Lists**

I WANT TO LEARN HOW TO MAKE MORE MONEY OUT OF THE FILTER BUSINESS.

NAME ____________________ **COMPANY** ____________________

ADDRESS ____________________

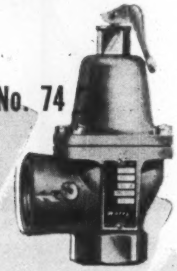
CITY ____________________ **STATE** ____________________

WATTS PRODUCTS

. . . for Boiler Heating Systems

For heating systems whether by hot water or steam, Watts pioneering research and engineering skill have produced protective and controlling devices that make water heating systems safe, efficient, automatic . . . Watts manufacturing efficiency and excellent workmanship provide you with quality controls, which enable you to render real service to your customers. Protect systems by installing the most advanced controls and safety devices.

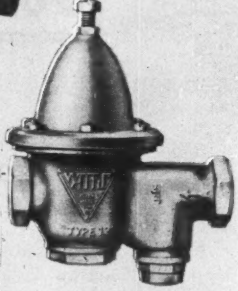
SEND FOR COMPLETE CATALOGUE



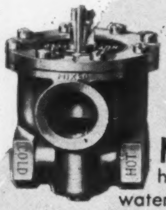
No. 74

No.174

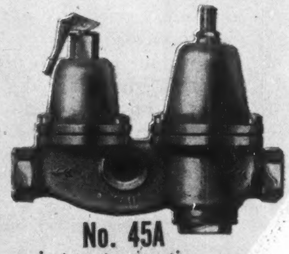
Nos. 74 and 174 series ASME boiler safety relief valves sizes $^3/_4$" thru 2"



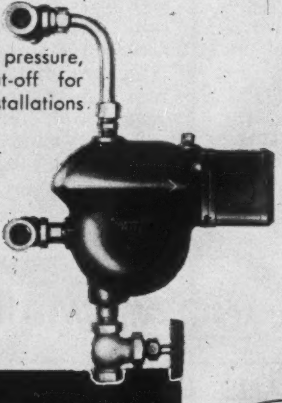
No. 135HW feed water pressure regulator



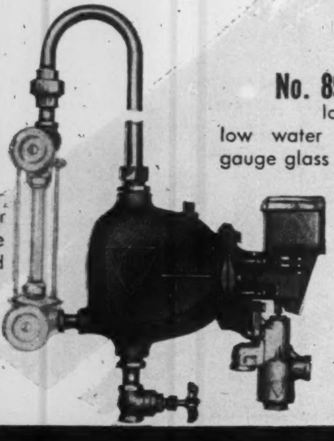
No. 71 hot and cold water tempering valve



No. 45A hot water heating dual control de luxe all bronze construction



No. 89A low pressure, low water cut-off for gauge glass installations



No. 60LWD newly redesigned combined boiler water feeder and cut-off complete with mercury switch and gate valve drain

WATTS REGULATOR COMPANY

Plumbing and Heating Safety Valves and Controls

Since WATTS LAWRENCE MASS U S A 1875

LAWRENCE, MASSACHUSETTS

Proved by Actual Test!

●

NEW SKIL Shear model 231 *outperforms all others!*

Yes, in every cutting test the NEW SKIL SHEAR Model 231 tops other makes by far! In cutting-time on the straightaway, in cutting right or left hand circles, in handling ease on every test job . . . SKIL Shear beats them all!

On a 25″ trial cut of 12 gauge metal, SKIL Shear averaged 9.2 seconds. Two other well-known makes required 12 and 15.3 seconds. On right and left hand circles, SKIL cut faster and tighter.

Reasons? A more powerful motor! Scientifically-designed cutting blades! Exclusive rear contour-grip handle! All combine to make SKIL Shear the leader in the metal cutting field!

The new SKIL Shear Model 231 is ideal for hot rolled steel up to 12 gauge; harder or softer metals in proportion. Cuts circles of 1½″ radius, either direction. Unusually lightweight . . . wonderfully well-balanced . . . bound to be the favorite with every metal man in your shop! Equipment includes extra set of blades, wrenches, removable side handle.

FREE!

Mail the Coupon for a Demonstration and a FREE Trial of the SKIL SHEAR Model 231! See How Much Faster, Easier-Handling this New SKIL Shear is on your Toughest Cutting Job!

●

Contact Your SKIL Distributor —or Your Nearby Factory Branch —for Complete Information.

SKIL
PORTABLE TOOLS

Made only by SKIL Corporation
formerly SKILSAW, Inc.
5033 Elston Avenue, Chicago 30, Illinois
3601 Dundas Street West, Toronto 9, Ontario
Factory Branches in All Leading Cities

Mail this coupon!

SKIL Corporation, Dept. HPAC-94
5033 Elston Avenue, Chicago 30, Illinois

☐ I would like a demonstration and free trial

☐ Please send literature on SKIL tools

Name____________________

Company____________________

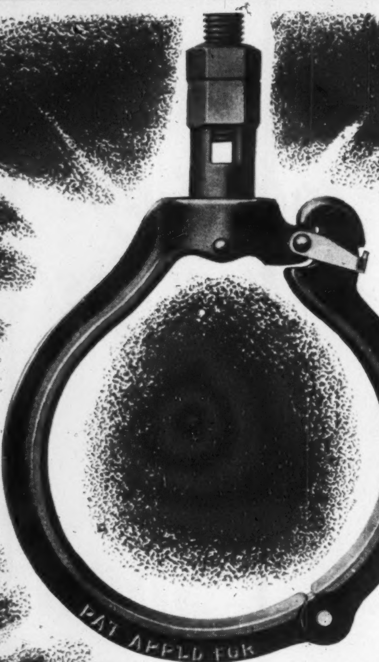
Street____________________

City__________ Zone_____ State______

GRABLER

SQUARE "GEE" PIPE HANGERS

relief from time-wasting grief



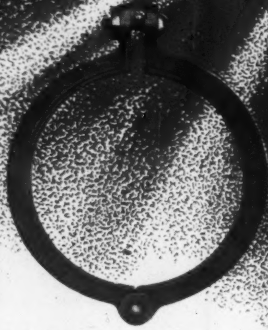


Fig. 317—Malleable Iron Hinged Hanger.

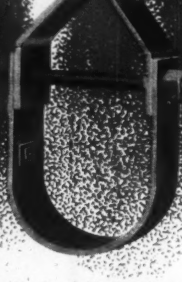


Fig. 97—Steel Clevis Approved by Underwriters' Laboratories and Factory Mutual Laboratories.

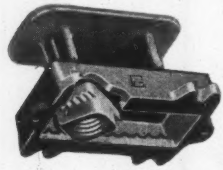


Fig. 315—Concrete Insert Approved by Underwriters' Laboratories and Factory Mutual Labs.

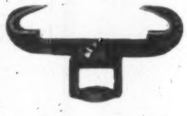


Fig. 392—Malleable Iron Adjustable, I Beam Clamps.

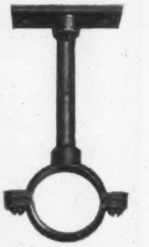


Fig. 65—Split Ring Hanger with Nipple and Plate.

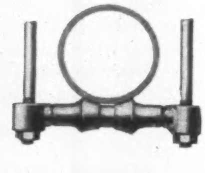


Fig. 103—Single Roller Hanger.

A DOUBLE CHECK of time-costs on any pipe hanging job will reveal that Grabler Square "Gee" Pipe Hangers are time-cost savings tools. Designed and fabricated to comply with modern engineering and construction practices, they give relief from time-wasting grief at the point of assembly. Many more types are illustrated in Grabler's Pipe Hanger Catalog. Ask your wholesaler for Grabler Square "Gee" Pipe Hangers.

THE GRABLER MANUFACTURING COMPANY
6565 Broadway • Cleveland 5, Ohio

THE SQUARE "GEE" LINE INCLUDES: Malleable Fittings • AAR Fittings • Unions • Rail Fittings • Cast Iron Steam Fittings • Cast Iron Drainage Fittings • Patented Drainage Fittings • Copper Tube Solder-Joint Fittings • Cast Brass Solder-Joint Drainage Fittings • Steel Pipe Nipples • Hangers

WAREHOUSES: New York • Philadelphia • Atlanta • Pittsburgh • Cincinnati • New Orleans • Dallas • Chicago
St. Louis • Minneapolis • Denver • San Francisco • Los Angeles

OUT OF SIGHT—OUT OF MIND—

Conduit containing 10 pipes in typical installation. Contains no joints, no voids. Z-Crete is as permanent as the earth itself!

Permanently!

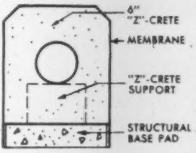
...when underground heated piping is insulated with "Z"crete®

Only Z-Crete, the Modern Monolithic Insulation, Makes It Possible to Insulate a Job and Forget It!

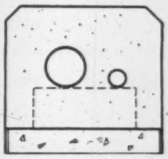
Z-Crete, the lightweight, resilient, insulating concrete specially designed for underground heated piping *you can install and forget!* It's as permanent as the earth itself.

Z-Crete's stability and high water resistance make it a good protector against pipe corrosion, as well as an excellent insulator. It is poured directly and monolithically around the piping, eliminating joints or voids. Fireproof, rotproof and verminproof, Z-Crete serves a dual purpose—the insulating concrete is both the structural conduit and the insulation. Any number, size, or arrangement of pipes can be designed into a Z-Crete conduit. Inquire today . . . there's an experienced, licensed applicator near you!

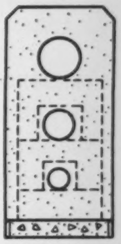
USE Z-CRETE FOR ANY HEATED UNDERGROUND SYSTEM


6" "Z"-CRETE
MEMBRANE
"Z"-CRETE SUPPORT
STRUCTURAL BASE PAD

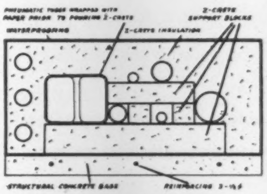
SINGLE PIPE CONDUIT



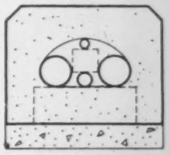
TWO PIPE CONDUIT



PIPE OVER PIPE


PNEUMATIC TUBES WRAPPED WITH PAPER PRIOR TO POURING Z-CRETE
WATERPROOFING
Z-CRETE INSULATION
Z-CRETE SUPPORT BLOCKS
STRUCTURAL CONCRETE BASE
REINFORCING

MULTIPLE PIPE CONDUIT



MULTIPLE PIPE CONDUIT WITH STEAM TRACER

"Z"crete®
DIVISION
ZONOLITE COMPANY
135 South La Salle Street • Chicago 3, Illinois

Z-Crete is furnished and installed only by licensed applicators of Zonolite Company under U. S. Patent No. 2355966—Canadian Patent No. 439356.

Write for **FREE** *Booklet*

Z-CRETE DIVISION,
ZONOLITE COMPANY
Dept. H-94
135 S. LaSalle St.,
Chicago 3, Ill.

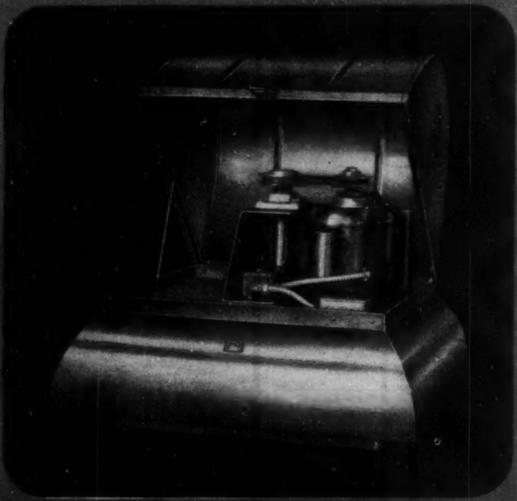
Please rush FREE Z-Crete Booklet with full details and specifications about this easier, better insulation for underground heated piping.

Name...
Company...
Address...
City..................Zone.......State.........

ALADDIN

Centrifugal

ROOF VENTILATORS



- THIRTEEN SIZES
- SELF CONTAINED
- QUIET OPERATING
- COMPLETE PERFORMANCE DATA

ALADDIN Centrifugal Roof Ventilators are furnished in thirteen sizes . . . direct and belt driven. Ruggedly built, these units have been designed especially for those installations where positive year around powered ventilation is required.

ALADDIN Roof Ventilators are described in the first complete engineering bulletin yet published on similar units. This bulletin contains full performance tables, characteristic curves and other data required for the proper selection of such equipment.

WRITE FOR BULLETIN 410

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIF.
REPRESENTATIVES IN ALL PRINCIPAL CITIES IN THE WEST

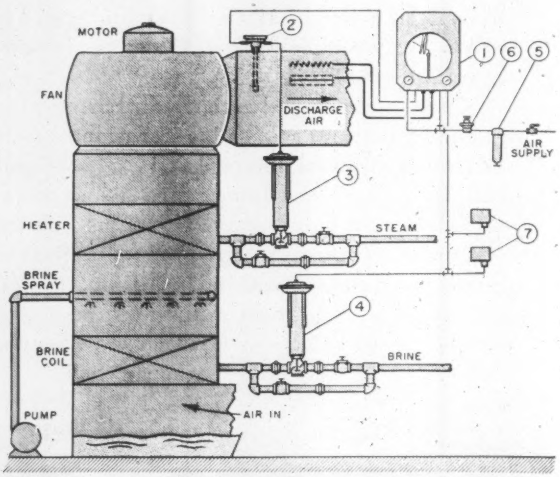
How cold is CORRECT?

IN meat packing and storage rooms, *correct* temperatures are vital. The maintenance of that temperature *constantly* has a great bearing on product marketability and profitable operation. The Taylor control system shown below will not only do this, it will also maintain the right humidity. Result—money saved on shrinkage losses and operating costs.

In this system a Taylor Recording Wet and Dry Bulb Temperature Controller operates valves in the brine or ammonia inlet lines and a humidifying valve in the steam line. It gives a permanent record of both the room temperature and humidity.

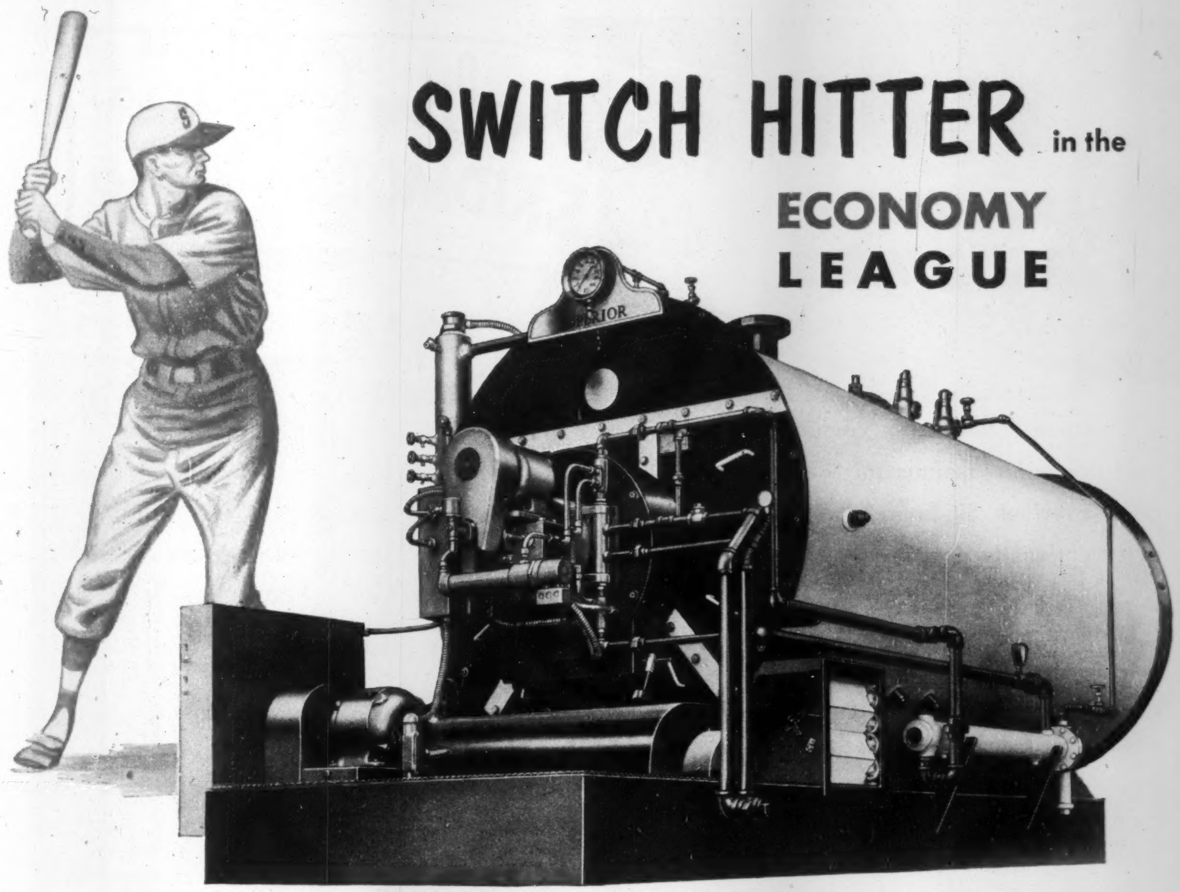
For information about this and many other Taylor control systems for Air Conditioning, Heating and Ventilating, write for **Catalog 5**—or call your Taylor Field Engineer. Taylor Instrument Companies, Rochester, N.Y., or Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.



Taylor Instruments
MEAN ACCURACY FIRST

SWITCH HITTER in the ECONOMY LEAGUE



SUPERIOR
STEAM GENERATORS

Just as the switch hitter changes his batting stance to take full advantage of the pitching situation, Superior Steam Generators change fuels to take advantage of the price situation. When equipped with combination gas/oil burners, Superior Steam Generators switch from one fuel to the other quickly, and without dismantling the equipment or interrupting the steam supply.

Superior Steam Generators are completely factory-assembled and fully tested prior to shipment for guaranteed performance exceeding 80% thermal efficiency, fully automatic . . . burning oil or gas . . . and are available in 18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water. For complete details write for catalog 604.

for performance you can **BANK** on

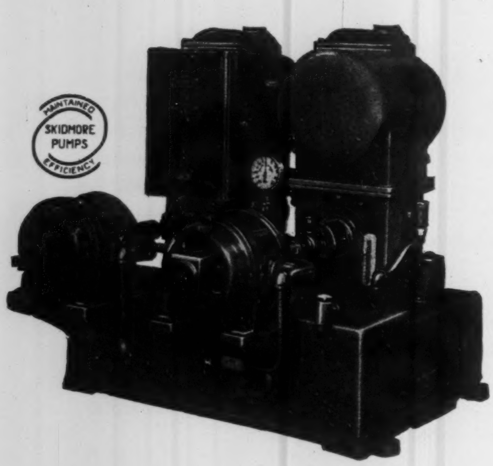
SUPERIOR
STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

The Quality Pump is
the SKIDMORE Pump

If you're interested in reducing installation and maintenance costs — don't overlook Skidmore's wide range of exceptionally dependable pumps.

Designed specifically for every installation requirement . . . Skidmore Pumps are built compactly and are easily installed, whether for below floor level returns or in cramped quarters. Experience of over a quarter of a century insures peak performance and longer service life.



SKIDMORE VACUUM PUMP

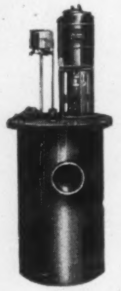
Automatically adjust to the varying conditions of the system. Capacities — ranging from 5,000 to 100,000 sq. ft. EDR. Available in both single and duplex units.

SKIDMORE
— PUMPS —

SKIDMORE CORPORATION **St. Joseph, Michigan**

. . . FOR A SPECIFIC PUMP REQUIREMENT.

If you are faced with the responsibility of a choice, Skidmore offers many types and units for you to select the correct design to meet your individual requirements.

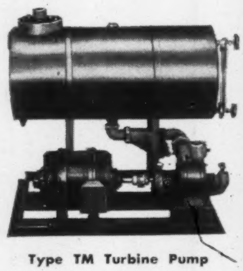


Type UV Condensate Pump

Type UV Condensation Pump is designed for below floor level returns, and is built in single and duplex units.

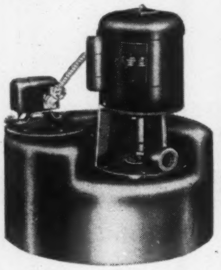
Type HS Condensate Pump

Type HS Pump is recognized for its dependable low operating cost. Capacities range from 1,000 to 65,000 sq. ft. EDR and pressures from 10 to 75 pounds.



Type TM Turbine Pump

Type TM High Pressure Turbine Pump. Designed for pressures up to 150 pounds and boilers to 250 H.P.



Type CV Vertical Pump

Type CV Vertical Pump is ideal where space is limited. This model like every Skidmore Pump is built to meet specific requirements. For the correct solution to your own pump problem consult a Skidmore Heating Pump Specialist.

SPECIFY SPORLAN LMC

and get PEAK PERFORMANCE on all Flooded Systems

with the

Sporlan LMC

LEVEL MASTER CONTROL

SPORLAN
SPORLAN TYPE W
TYPE M
TYPE D

Again Sporlan offers you a NEW FIRST!...

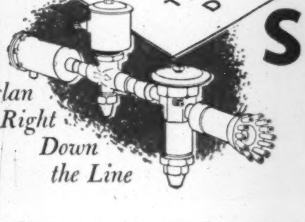
A Positive Liquid Level Control for Ammonia, Freon-12, and Freon-22 with all these features!

First, the Sporlan LMC consists of a standard Sporlan Thermostatic Expansion Valve equipped with a matched Sporlan Level Master Element. That means that the liquid level control and the expansion device are combined into one unit, and you have a choice of Sporlan Thermostatic Expansion Valves for Freon-12 and Ammonia up to 100 tons, and for Freon-22 up to 180 tons... *thus no job is too large or small for the Sporlan* **LMC**. *Existing flooded systems can be easily and economically modernized and made automatic with the Sporlan* **LMC**. *The Sporlan* **LMC** *provides a* MODULATED FLOW *and maintains practically a static liquid level in the low side! The Sporlan* **LMC** *insert bulb has* NO MOVING PARTS!

Any two wire power supply of 115 or 230 volts, any frequency AC or DC, is adequate. The Sporlan LMC insert bulb can be installed in either a horizontal, vertical or angle position for direct contact with the refrigerant. If the liquid level drops, a heater element in the bulb acts as an artificial superheat increasing the pressure in the thermostatic element, thereby opening the valve. If the liquid level rises, its refrigerating effect on the bulb overcomes the heater, and the valve throttles.

The Sporlan **LMC** *is* NOT *affected by turbulance... tight closing* IS *assured... there is no current flow through refrigerant... and only proven thermostatic expansion valve performance is employed!*

WRITE TODAY FOR COPY OF BULLETIN 60-15...
THEN SPECIFY SPORLAN LMC FOR ALL YOUR FLOODED JOBS!

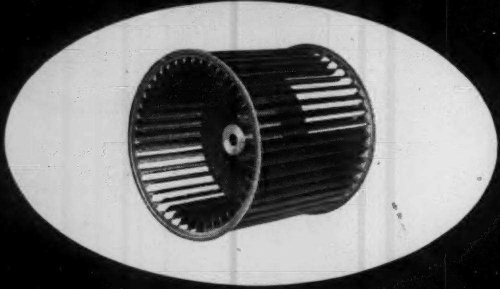


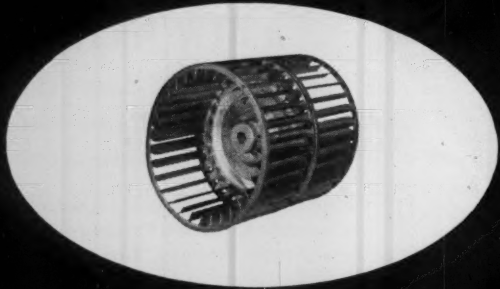
Buy Sporlan Right Down the Line

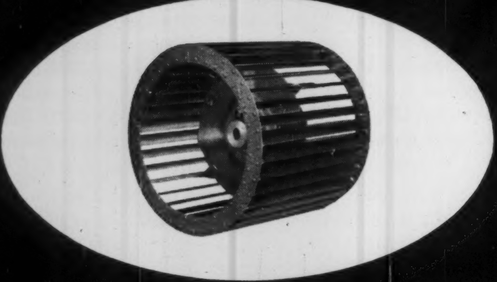
SPORLAN VALVE COMPANY
7525 SUSSEX AVE. ST. LOUIS 17, MO.

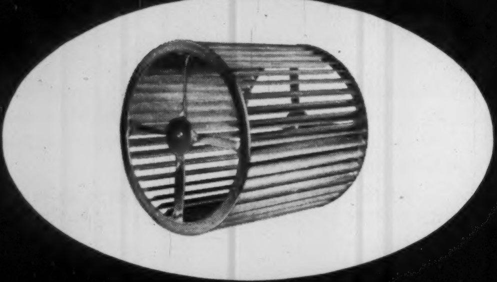
EXPORT DEPARTMENT... 89 BROAD ST., NEW YORK 4, NEW YORK

LAU Specialized Blower Wheels









in a tremendous range of sizes . . . for every need!

You'll find LAU your BEST source of Blower Wheels of every size and type . . . because LAU is specialized for production tooling of highest quality at low cost.

Single Inlet . . . End Suspended . . . Center Suspended . . . Double Inlet . . . forward curve centrifical Blower Wheels with baked aluminum enamel finish. Can also be supplied with Hot-Dip Galvanize or Ruspruf special finishes.

Many sizes available with Power Lock Hubs.

SIZES:

1 3/4″ to 30″ width
4 1/4″ to 30″ diameter

BORES:

0 1/4″ to 3 1/2″

CAPACITY RANGE

50 to 22,000 cfm
0″ to 2″ static pressure

Write today for catalog pages 707

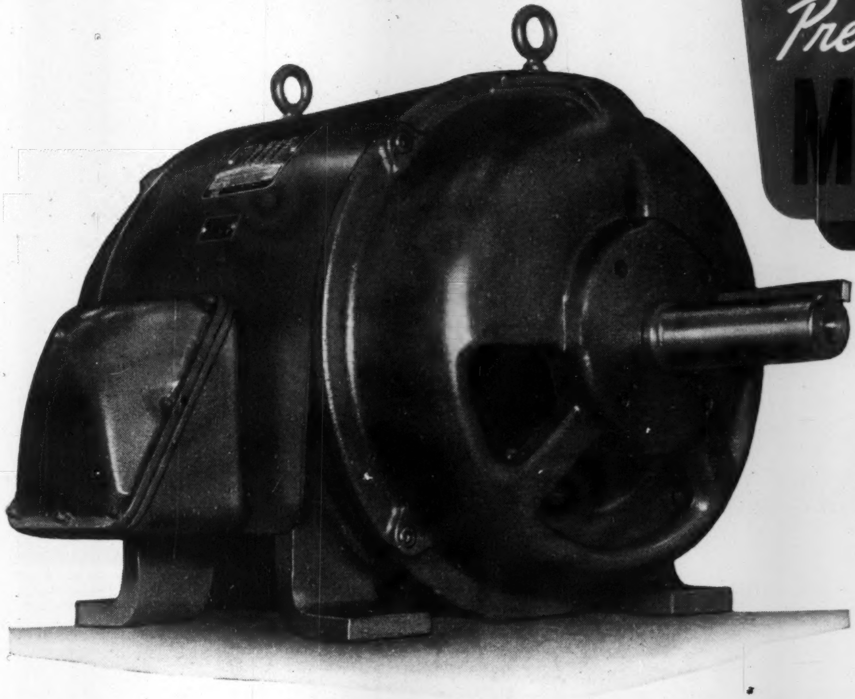
THE LAU BLOWER COMPANY • **Dayton 7, Ohio**

LAU World's Largest Manufacturers of Air Conditioning Blowers

FOR FAN SERVICE...

"All motors are NOT alike!"

RELIANCE
Precision-Built
MOTORS



Reliance Protected Open A-c. Motor. All other standard enclosures available, with wide choice of mechanical designs and special mountings. Ratings from ¾ to 300 hp.

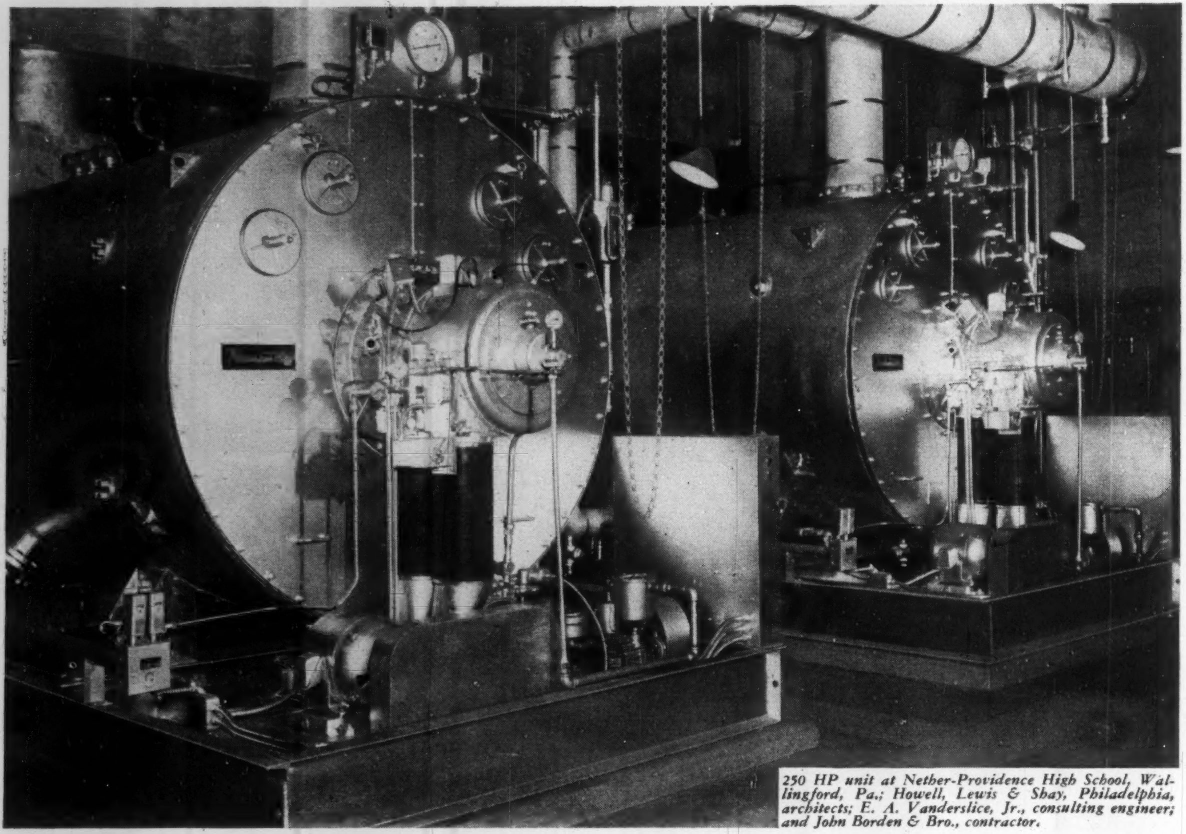
- ☆ Low starting currents... liberal ratings
- ☆ Smooth acceleration... quiet operation
- ☆ Tough, vibration-proof Reli-X insulation

... AND THE BEST PRE-LUBRICATED BEARING DESIGN
The Reliance pre-lubricated bearing provides *four times more operating hours without re-lubrication* than any other bearing used in motors today. And—whatever your lubrication schedule—*you just can't grease'em wrong!* To get the complete "inside story" on motor bearings, write today for Bulletin B-2201. It contains hard facts on the advantages of the Reliance pre-lubricated bearing design, with cutaway view, cross-section diagram, comparison chart, and statements by bearing manufacturers. B-1458D

RELIANCE ELECTRIC AND ENGINEERING CO.

1052 Ivanhoe Road, Cleveland 10, Ohio • *Sales Representatives in Principal Cities*

at SCHOOLS and COLLEGES



250 HP unit at Nether-Providence High School, Wallingford, Pa.; Howell, Lewis & Shay, Philadelphia, architects; E. A. Vanderslice, Jr., consulting engineer; and John Borden & Bro., contractor.

Powermaster® Excels in All Tests

ALL OVER AMERICA, steam and hot water requirements for public and parochial schools, private schools, trade schools, and colleges are being supplied by *Powermaster* Packaged Automatic Boilers . . . with an outstanding record of reliability and economy. Why have they been so widely "accepted" in educational circles by men who can evaluate the aptitude of boilers for this particular kind of service? Because by all standards of comparison, *Powermasters* possess these qualifications for "enrollment" in any kind of school: Ease and economy of installation—space-saving compactness—fuel-saving smokeless combustion—fuel-saving operation at *all* loads—maintenance-saving accessibility—completely automatic operating and safety controls—minimum attention of service personnel.

Compare *Powermaster* with any other packaged boiler and you'll understand why it is today's best buy for institutions of learning . . . or buildings . . . or hospitals . . . or industrial plants. Send for latest descriptive bulletin.

O&S

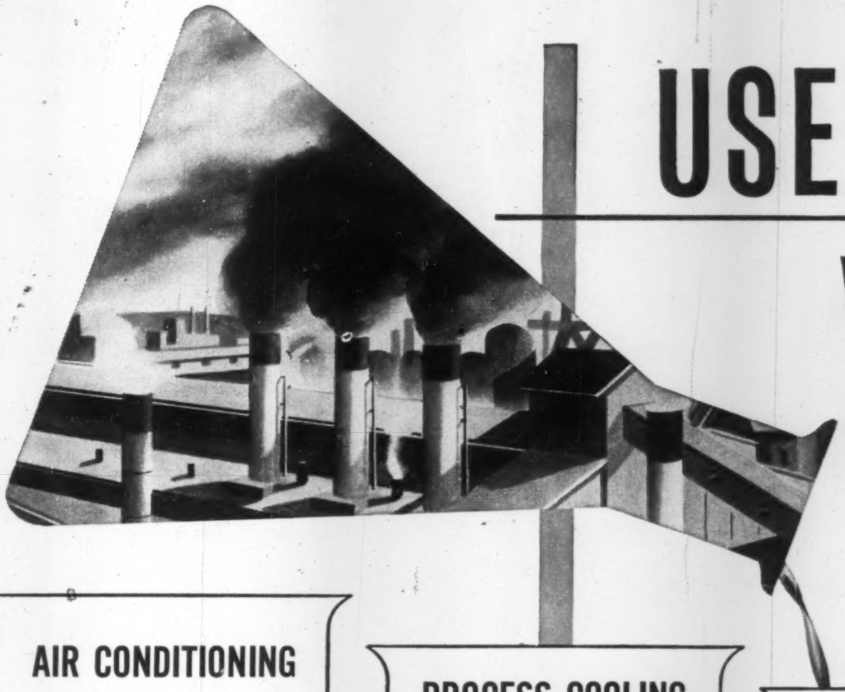
Powermaster®

PACKAGED AUTOMATIC BOILERS

In sizes to 500 HP; pressures to 250 psi.

Powermaster

ORR & SEMBOWER, INC. • Established 1885 • **Morgantown Road, Reading, Penna.**

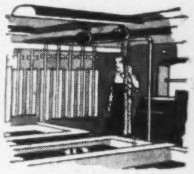


USE WASTE HEAT!

AIR CONDITIONING

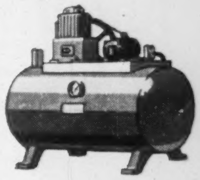
Let the adaptable Servel 25-ton Water Chiller convert waste heat, or steam from any source, into lowest cost air conditioning for your plant and offices!

PROCESS COOLING

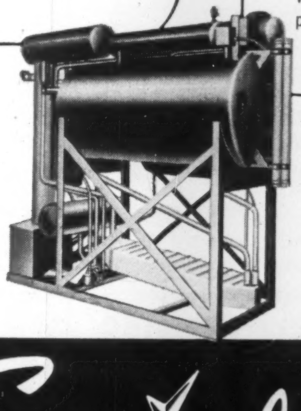


Use the cheapest energy source —even waste heat—to achieve high-efficiency cooling for manufacturing processes! Servel Water Chiller operates on dependable absorption principle.

INDUSTRIAL PRECOOLING



Increase capacity and improve performance of air compressors and internal combustion machines! The Water Chiller is compact, light; can be safely installed on almost any floor.



The Servel Water Chiller cooling system has no moving parts to wear. It is quiet and vibration-free. Light floor loading and freedom from vibration mean that no special foundations or braces are needed. Zone control is unusually easy. And operation (using waste heat, or steam from the cheapest source) is low in cost. Backed by a 5-year warranty. See your dealer or mail coupon for information and engineering co-operation.

Servel

the name to watch for great advances in

AIR CONDITIONING ✓ REFRIGERATION

SERVEL, INC., Dept. HP-94 Evansville 20, Indiana

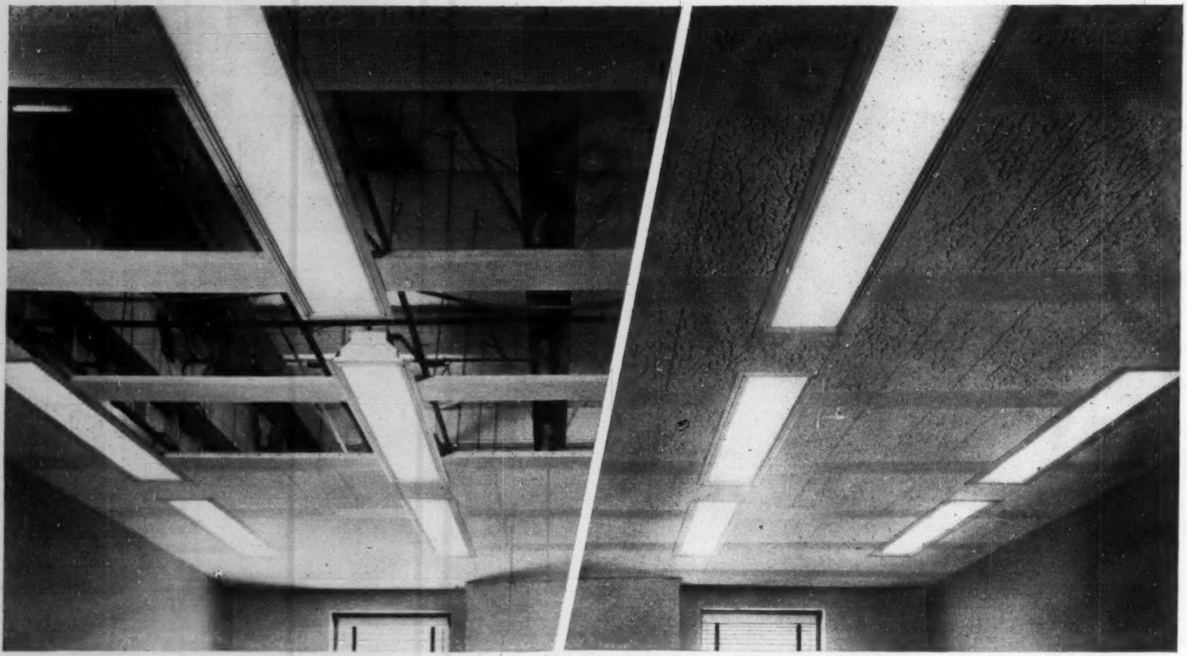
Please send me complete information on Servel equipment for
☐ Air Conditioning, ☐ Process Cooling, ☐ Industrial Precooling.

Name____________________

Firm____________________

Address____________________

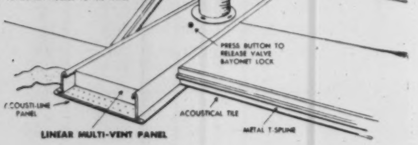
City__________ County________ State______



new! Out-of-sight

AIR DIFFUSERS for acoustical block ceilings!

Now Pyle-National Multi-Vent® air diffusing panels, adapted for concealed installation in Celotex Acousti-Line ceilings, provide advantages heretofore possible only with metal pan.



1½" CHANNEL AND HANGER CLIPS
RAISE ACOUSTICAL TILE TO OBTAIN ACCESS TO THE PANEL
PRESS BUTTON TO RELEASE VALVE BAYONET LOCK
ACOUSTI-LINE PANEL
ACOUSTICAL TILE
METAL T-SPLINE
LINEAR MULTI-VENT PANEL

The perforated face of Acousti-Line metal suspension panels act as diffusing plates for Multi-Vent units. No special supports are needed. Flexible connection minimizes need for accurate alignment between duct opening and Acousti-Line panels.

Note ready access to Multi-Vent unit for cleaning or valve adjustment.

NEW SMUDGE-FREE OPERATION—Multi-Vent's low velocity air delivery eliminates the dirtying or discoloration of adjacent acoustical blocks, a costly maintenance problem with high velocity diffusion.

NEW BEAUTY—Out-of-sight installation eliminates all protruding outlets and unsightly grilles. Permits complete freedom of interior design and decoration.

NEW LOWER INSTALLATION COST—Multi-Vent units can be assembled, connected to the duct, and seated in the metal suspension panels in just a few seconds. No tools are required . . . no cutting of blocks necessary.

AND, MOST IMPORTANT OF ALL—Air distribution by Multi-Vent's gentle pressure displacement assures perfectly even air motion and exceptional uniformity and control of room temperatures. The total absence of strong air streams or blow eliminates all usual sources of draft complaints and permits complete freedom in relocating partitions.

For complete information about Multi-Vent installations for all types of ceilings consult the Pyle-National Sales Engineer in your vicinity, or write direct.

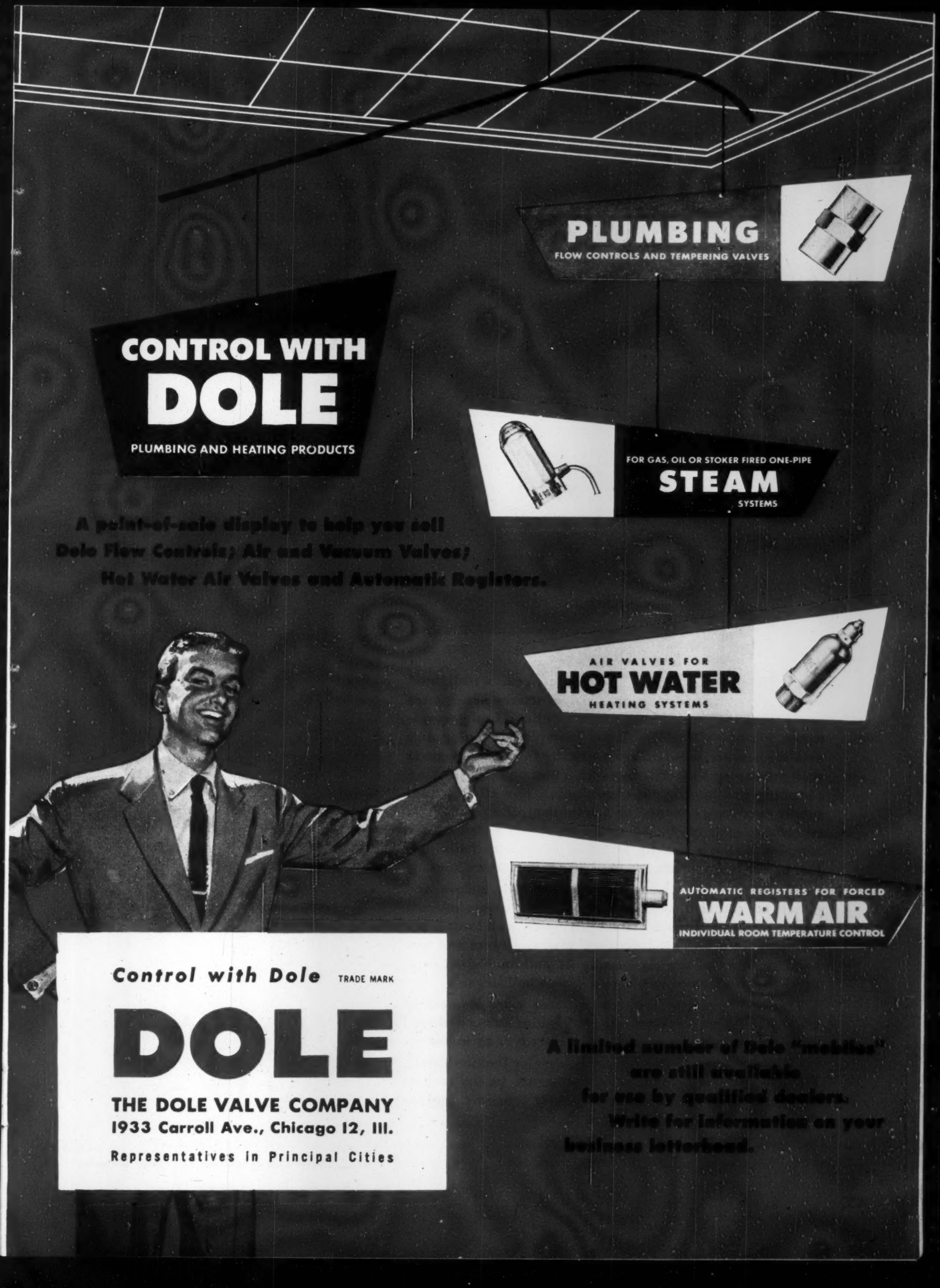
MULTI-VENT DIVISION

Sales and Engineering Representatives in Principal Cities of United States and Canada

THE PYLE-NATIONAL COMPANY

1373 North Kostner Avenue
Chicago 51, Illinois

TURBO-GENERATORS • FLOODLIGHTS • PLUGS AND RECEPTACLES • CONDUIT FITTINGS


CONTROL WITH
DOLE
PLUMBING AND HEATING PRODUCTS
PLUMBING
FLOW CONTROLS AND TEMPERING VALVES
FOR GAS, OIL OR STOKER FIRED ONE-PIPE
STEAM
SYSTEMS
AIR VALVES FOR
HOT WATER
HEATING SYSTEMS
AUTOMATIC REGISTERS FOR FORCED
WARM AIR
INDIVIDUAL ROOM TEMPERATURE CONTROL

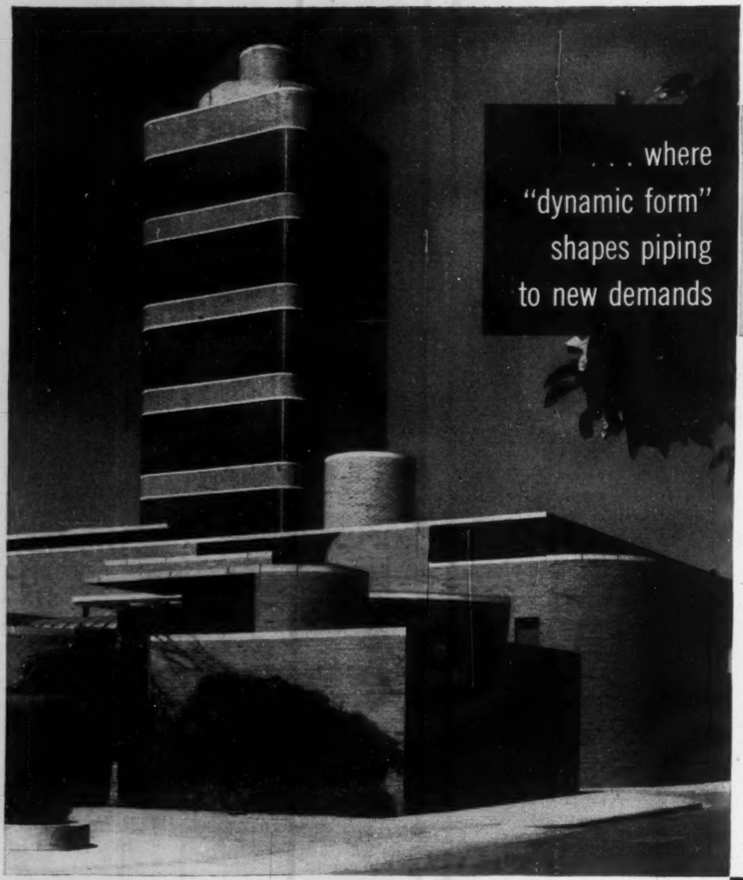
A point-of-sale display to help you sell Dole Flow Controls; Air and Vacuum Valves; Hot Water Air Valves and Automatic Registers.

Control with Dole TRADE MARK

DOLE

THE DOLE VALVE COMPANY
1933 Carroll Ave., Chicago 12, Ill.
Representatives in Principal Cities

A limited number of Dole "mobiles" are still available for use by qualified dealers. Write for information on your business letterhead.



. . . where "dynamic form" shapes piping to new demands

JOHNSON'S WAX

adds new evidence to the efficiency record of Jenkins Valves

JOHNSON WAX TOWER

Architect: FRANK LLOYD WRIGHT
General Contractors: WILTSCHECK AND NELSON, INC.
Consulting Mechanical Engineers:
SAMUEL R. LEWIS & ASSOCIATES
Piping Contractor: JOHN FEINER PLUMBING COMPANY

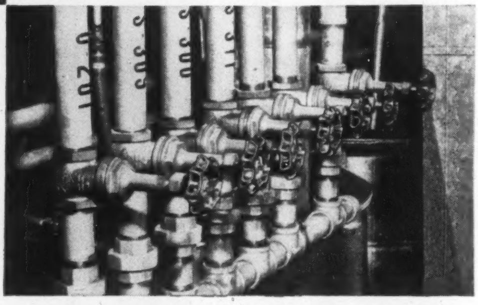
Symbolic of the advanced design principles that guided the building of the Johnson's Wax Administration and Research Center at Racine, Wisconsin, is the world-famed core-supported Research and Development Tower. Designed by Frank Lloyd Wright, this modern, 14-story laboratory provides every facility known to science for the continuous development and improvement of Johnson's Wax products.

The efficient use of space to provide open, well-lighted working areas in modern industrial structures necessitates careful planning of various plant service lines. In the world-famed Johnson's "Heliolab", for example, all piping and duct systems are standardized vertically in a single central shaft measuring 13 feet in diameter. Thus, pipelines serving plumbing and heating, air-conditioning, and all apparatus supply needs are confined to a minimum of space. Direct takeoffs at each of the 14 operating floors eliminate the complex hookups usually found in laboratory buildings. More than 1700 valves are used in tower service lines.

To assure trouble-free operation of such unique and closely coordinated facilities, all components were selected on the basis of proved dependability, safety, and long-range maintenance economy. Johnson's Wax engineers had first hand evidence of the high rating of Jenkins Valves from previous installations in plant and office buildings.

This confidence in the demonstrated *extra measure* of efficiency and economy provided by Jenkins Valves is shared by plant operating managements in every type of industry.

Despite this extra value, *you pay no more* for Jenkins Valves. For new installations, for all replacements, let the Jenkins Diamond be your guide to lasting valve economy. Jenkins Bros., 100 Park Ave., New York 17.



For a new addition to the wax manufacturing building, most recent enlargement of the Johnson's Wax plant, Jenkins Valves were again chosen. Above they are shown in a process piping hookup which supplies raw materials to a series of mixing kettles. Piping contractor for the new addition was Advance Heating Company, Racine, Wis.

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864 TRADE JENKINS MARK
Jenkins Bros

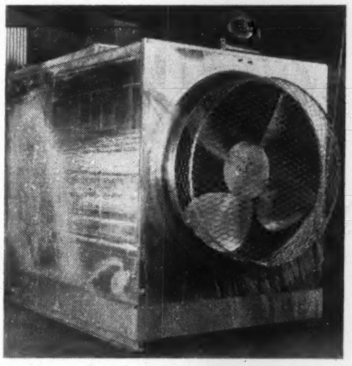
Sold through Leading Industrial Distributors Everywhere

EQUIPMENT DEVELOPMENTS...

For reviews of Recent Trade Literature see page 254.

Galvanized Cooling Towers

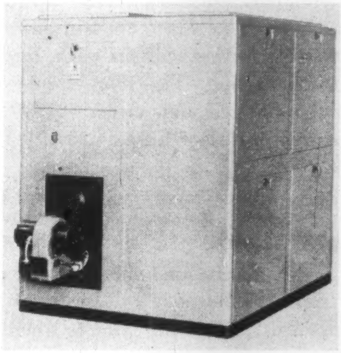
New line of induced draft hot dip galvanized cooling towers. . . .The various sections of the tower are hot dipped galvanized before they are assembled to prevent rusting. The manufacturer states that the entire unit can be knocked down to overcome installation problems. The all-heart redwood decking is removable for cleaning. Nine models in the "Series CF" range from 3 to 50 tons capacity. Applications include small air conditioning and refrigeration installations and air compressor cooling.



Manufacturer—Dover Mfg. Co., P. O. Box 498, Independence, Mo.

Oil Burning Furnaces

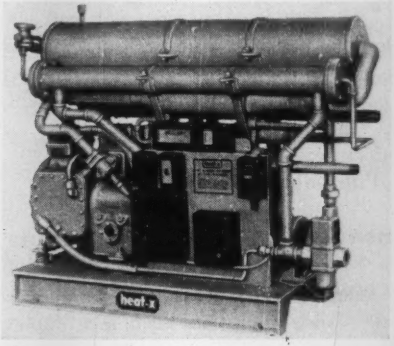
Two new industrial sized oil burning furnaces of 336,000 and 448,000 Btu per hr bonnet output, known as models "OL-336E" and "OL-448E" . . . . The heating element is shipped with the combustion chamber already in place. It is 27 in. wide and 66 in. high, enabling it to pass through any standard doorway. The unit features a heavy steel pan bottom, reversibility of the blower compartment from left to the right side of the furnace, and elimination of combustion chamber construction. The manufacturer says that it can be connected to a very low chimney because the internal resistance is less than 0.02 in. W. G. The furnace itself is designed to operate at 0.4 in. external static pressure.



Manufacturer—International Heater Co., 101 Park Ave., Utica 2, N.Y.

Package Chillers

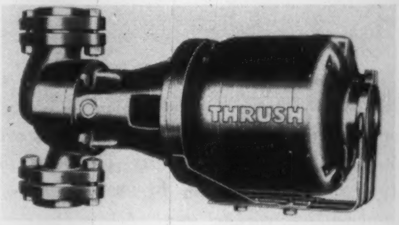
Package chillers for chilled water air conditioning systems and other industrial water cooling uses. . . .Available in models from 2 hp through 15 hp, the new "PC" units are furnished completely wired, charged with "Freon," requiring only power and water connections. Condensers, chillers and heat exchangers of the units are of the "Inner-Fin" construction designed to give greater capacity with less bulk. Circulating pumps are of the non-overloading type with mechanical seals to eliminate danger of leaks. On the 10 and 15 hp models, two separate refrigeration systems with thermostatic controls in the water return lines to the chillers permit operation at 50 percent capacity when required.



Manufacturer—The Heat-X-Changer Co., Brewster, N.Y.

Horizontal Water Circulator

Improved horizontal water circulator designed for easier installation, greater capacity and quieter operation . . . . In the new model, one circulator serves for four different sizes by having two interchangeable bolt flanges with ¾ in., 1 in., 1¼

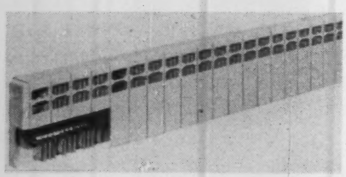


in. and 1½ in. pipe tappings. Other new features include an adjustable motor cradle, new type resilient motor mounting rings, spring coupling to eliminate vibration and continuous oil bath lubrication of circulator bearings.

Manufacturer—H. A. Thrush & Co., Peru, Ind.

Baseboard Panel Radiator

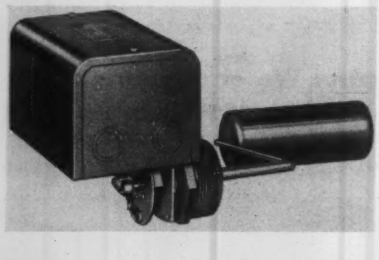
Baseboard panel radiator installed 3 to 4 in. above the floor and connected to central heat source of hot water or steam . . . . Installation several inches above the floor provides "flue-action" with the cool air entering the bottom of the radiator, the manufacturer states. The baseboard radiator is 3 in. wide, 8 in. high and assembled in 2 in. sections from 2 ft, 5 in. to 72 ft, 7 in. lengths in opposite end supply and return tapping and 2 ft, 3 in. to 36 ft, 7 in. lengths in right or left end supply and return tapping to fit room piping connections. The unit is packaged with all accessories ready for on the job installation.



Manufacturer—Shaw-Perkins Mfg. Co., 201 E. Carson St., Pittsburgh 19.

Alternator for Condensate Pumps

Screw-in tank alternator for condensate pumps providing a means for alternating the operation of two pumps installed in a duplex system with a common tank. . . .The new "Class 9038 CG" alternator is interchangeable in tank mounting with the standard "Class 9037 HG" screw-in tank float switch. The manufacturer says that it is possible to change the float position from the right to the left hand side or vice versa. Contacts may be converted to either open or close on liquid rise. Switches are available for 110, 220, 440, 550 volts. The structure consists of two 2-pole, double break, silver to silver, visible and vertical contact mechanisms.



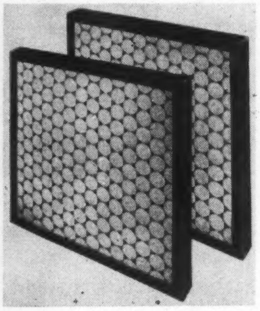
Manufacturer—Square D Co., 4041 N. Richards St., Milwaukee 12.

Capacitors for Air Conditioners

Two-in-one capacitors for air conditioners designed to provide the power factor correction of two single capacitors of the same voltage ratings. . . .According to the manufacturer, they can be applied wherever electrical circuits in air conditioners are designed for two running capacitors and a method of switching. Enclosed in a solderless steel case, the units are composed internally of "Kraft" paper and dead-soft annealed aluminum foil impregnated with "Pyranol" dielectric. The dual section capacitors are available with fork or quick-connect bushing terminals. Each unit has three bushings, one of which is common to both sections. Voltage ratings are 236, 250, 330 or 440 a-c with selective microfarad ratings.

Manufacturer—General Electric Co., 1 River Rd., Schenectady 5, N.Y.

Capacitor



Filters

Glass Fiber Filters

New type of disposable air filter using a specially processed glass fiber that will not disintegrate or splinter. . . .Designed for winter and summer air conditioning equipment, the glass fibers are bonded together so that the filter pack remains firm. The manufacturer states that this special process makes the fibers soft so that small particles of glass fiber will not break off and circulate through the air stream. In addition, the fibers are laid down to permit specific graded densities with the pack, thereby eliminating surface loading. The filter frame is of box construction reinforced with metal.

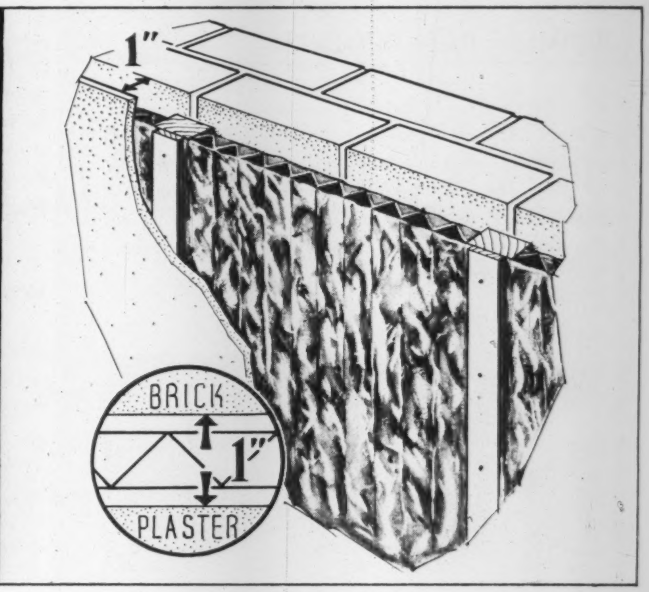
Manufacturer—Filtrex Corp., 33-40 127th Pl., Corona 68, N.Y.

Limit Controller

Electronic limit controller designated the "700 Series Limitrol". . . .Designed to guard against human or instrument failures which may permit overshooting of critical temperatures, it automatically shuts off the fuel supply at a specified temperature manually set on the indicating scale. If so desired, it will sound an alarm. The instrument incorpo-

[*Continued on page* 240]

How to Insulate Masonry Walls and Minimize Dampness and Heat Flow



MASONRY WALLS—brick, stone, cinder or concrete blocks—can be insulated against heat and vapor flow economically and effectively with 2 sheets of aluminum separated ½" apart by an accordion fiber. They can be attached in one operation to furring strips on the inside. Only ½" deep installed, they fit into the shallow 1" spaces created by the furring. The whole cost, material plus labor, should not exceed 7½¢ sq. ft.

In basements and other places in *existing* buildings with masonry walls, insulated areas can be created for active use for playrooms, storage, laundries, workshops, even living quarters, by the same technique of attaching multiple accordion aluminum and reflective spaces to furring strips.

HEAT AND VAPOR FLOW RETARDED

With respect to radiant heat flow, the aluminum surfaces have 97% reflectivity and only 3% absorptivity and emissivity. Low conduction results from the preponderant air spaces of low density. The layers of multiple aluminum and fiber retard inner and outer convection.

To obtain MAXIMUM uniform depth protection against heat loss and condensation formation, it is necessary to use the new edge-to-edge multiple aluminum*, each sheet of which stretches from joist to joist, and also all through the flanges for further vapor protection as well as permanent attachment of each sheet.

***Patent applied for.**

COST OF INFRA INSULATION PLUS LABOR

Type 4-S Jr.—7½¢ sq. ft.

INFRA INSULATION, INC., 525 Broadway, New York, N. Y.

The tough, continuous aluminum sheets are impervious to vapor flow. Infiltration under the flat stapled flanges is slight. Condensation formation on or within the aluminum sheets is minimized by the scientific construction of multiple layers of full-depth accordion aluminum, fiber and air spaces. They are available in pre-fabricated ½" depth, commercially known as Type 4 Jr. Infra Insulation.

HOW TO INSTALL

Attach 1" furring strips to walls on 16" centers. Tack flange of Type 4 Jr. to FACE of furring with staples, flat surface facing room. Nail rough lattice strips over flanges. This prevents contact with interior wall and creates additional air space. Finally attach wallboard, or lath for plaster.

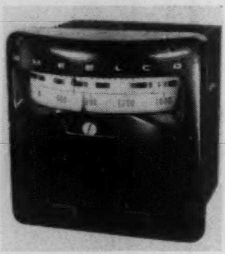
The U. S. NATIONAL BUREAU OF STANDARDS has published an informative booklet describing the destruction condensation can cause and means of preventing condensation. It is entitled "Moisture Condensation in Building Walls." Send us coupon for a FREE copy.

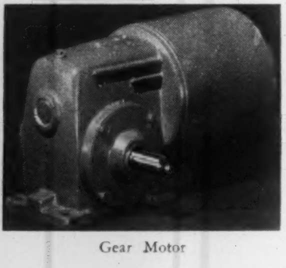
Get a FREE SAMPLE of this unusual insulation. Check the box in the coupon.

INFRA INSULATION, INC.
525 Broadway, N. Y. C., Dept H-9
Please send ☐ Samples of Infra ☐ N.B.S. pamphlet "Moisture Condensation in Building Walls."
Name____________________
Address____________________
Firm____________________

rates a thermocouple break protection feature which will shut off fuel input to a process in the case of thermocouple failure or broken thermocouple connections, the company says. The two-compartment case is gasketed for protection against dust and moisture.

Manufacturer—Wheelco Instruments Div., Barber-Colman Div., Rockford, Ill.


Controller


Gear Motor

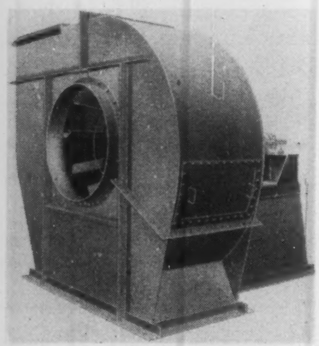
FHP Gear Motors

New line of fractional horsepower gear motors, smaller and lighter than previous designs . . . . The new right-angle and concentric-shaft gear motors are 10 percent lighter than older models, according to company engineers. The motors are reconnectable externally to reverse the direction of shaft rotation. Large bearings are locked to carry motor shaft thrust in either direction. The concentric-shaft motor and right-angle motors are available in ratings of 1/4, 1/3, 1/2 and 3/4 hp.

Manufacturer—General Electric Co., 1 River Rd., Schenectady 5, N.Y.

Centrifugal Exhaust Fans

Large industrial and material handling centrifugal exhaust fans . . . . The new type XL fans range in size from 11 in. to 60 in. inlet diameter wheels and will exhaust air volumes up to 130,000 cfm at static pressures up to 18 in. WG.



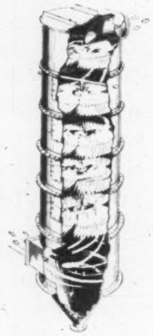
They provide universal discharge openings and the sizes ranging from 11 in. through 33 in. diameter can be furnished with three interchangeable wheels. The rotation of either the rim or open types of wheels may be reversed, while the backplate type of wheel is not reversible. For the sizes from 37 in. to 60 in. in diameter, wheels of either the rim or backplate type are available and interchangeable.

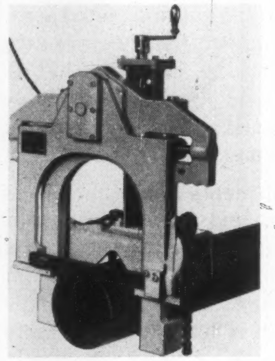
Manufacturer—Clarage Fan Co., Kalamazoo, Mich.

Wet Dust Collector

"Type CW-1" centrifugal wet dust collector for applications where a cloth type collector cannot be used. . . .It is of counter current design and of tower type construction. It consists of multiple wet vane sections and a final water entrainment vane section. The diameter of the collector varies in proportion to the air volume handled. In operation, the water supply enters above the top wet vane section and flows downward or counter to the upward flowing air, which enters the collector through the lower tangential inlet. Water and dust are discharged as sludge from the lower cone and the clean air is discharged from the air outlet at the top.

Manufacturer—Pangborn Corp., 400 Pangborn Blvd., Hagerstown, Md.


Dust Collector


Saw

Portable Power Saw

Portable power saw for on the job cutting of 2 in. to 8 in. cast iron and steel pipe, as well as bar stock and beams. . . .Weighing 120 lb and operating in a space of 25 in., the "Guillotine" saw is designed to cut pipe in a matter of minutes—depending on pipe characteristics. A chain pipe vise clamps the saw to the pipe. Machined cast steel "V" saddle bases are designed to give a square cut at right angles to the pipe. The pipe itself acts as the machine tool base.

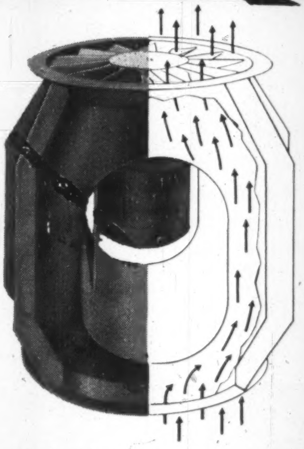
Manufacturer—E. H. Wachs Co., 1525 N. Dayton St., Chicago 22.

Igniters for Fuel Burners

Igniters and spark plugs for industrial and commercial oil and gas burners. . . .Accord-

[*Continued on page 242*]

TALL STACKS PROHIBITED



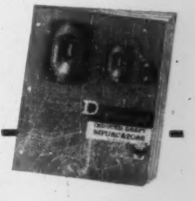
The Induced Draft Bifurcator is a motor-driven axial-flow fan in a divided housing. Motor is in an isolated chamber around which flue gases are by-passed so that motor always remains clean, accessible and at safe temperature. Induced Draft Bifurcators are built in 24 sizes, for high-pressure boilers delivering up to 60,000 pounds of steam per hour and for low-pressure boilers rated up to 190,000 EDR.

So Socony-Vacuum Lubricating Oil Plant insures boiler draft with Induced Draft Bifurcator Fans

This Socony-Vacuum oil blending and packaging plant is located near the Kansas City Airport, so they couldn't erect a tall stack for boiler draft. This restriction posed a problem because the plant requires two 150 HP boilers to provide steam for plant processes, tank car cleaning and barrel cleaning.

Socony-Vacuum engineers solved the problem by installing two Induced Draft Bifurcator Fans. One Induced Draft Bifurcator Fan is mounted in the breeching immediately above the boiler. The other Bifurcator is mounted on the roof because of limited space above boiler smoke outlet. These units provide adequate draft for the two 150 HP boilers — and they require only 12-foot steel stub stacks.

For full information on Induced Draft Bifurcators, simply **MAIL COUPON TODAY.**



DeBothezat Fans

Division of
American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

DeBOTHEZAT FANS DIVISION
American Machine and Metals, Inc.
Dept. HP-954, East Moline, Illinois

Please send free Bulletin DB-32-52 with full technical data on Induced Draft Bifurcators.

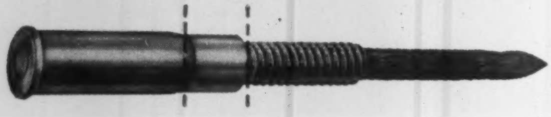
FIRM NAME

ADDRESS

CITY ZONE STATE

NAME AND TITLE

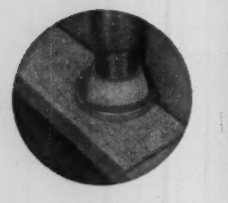
VELOCITY-POWER DRIVER'S
EXCLUSIVE INTEGRAL
CARTRIDGE—PISTON—STUD UNIT



lets you
LOAD FASTER
SHOOT SAFER

There's no time wasted matching loads and studs, no chance of dangerous mismatching with the Velocity-Power Driver. Our studs are factory assembled—you get cartridge, piston, stud as one unit—right for the job—ready to go! Cartridge heads are color tipped for load identification; center-fire cartridges add an extra margin of safety.

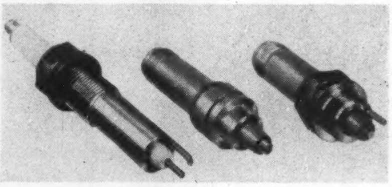
LISTED UNDER REEXAMINATION SERVICE UNDERWRITERS' LABORATORIES, INC. UL



Remember, too, with Velocity-Power Driver you have a wide variety of studs available; permanent spall shield that permits close-to-the-wall work, and interchangeable barrels that permit driving ¼" and ⅜" studs from same firing unit! Write for details.

VELOCITY POWER TOOL COMPANY
201 North Braddock Avenue
Pittsburgh 8, Pa.

ing to the manufacturer, these plugs eliminate difficulties encountered with center and ground electrodes.



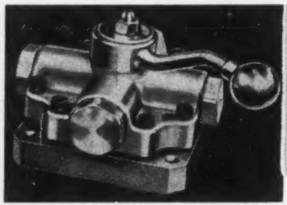
One type of plug eliminates the need of two plugs as formerly used. Another design is employed where high thermal corrosion and erosion occur from high velocity return gases.

Manufacturer—U. S. Igniter Corp., 2636 N. Hutchinson St., Philadelphia 33.

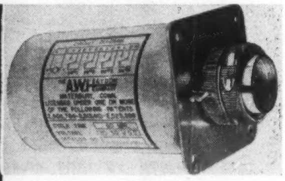
Poppet Valve

Poppet valve 2 in. high with rotary handle action, recommended for machine tool operation. . . .Called the "Pancake," it has a bottom ported base and is available in ¼ and ⅜ in. pipe sizes. The valve is a four way unit and seals with air pressure. The pressure rating is 125 psi and the maximum recommended operating temperature is 175 F. The company states that this valve may be used for higher or lower pressures and for other than air services under special conditions.

Manufacturer—Ross Operating Valve Co., Dept. 1403, 120 E. Golden Gate, Detroit 3.



Valve



Timer

Repeat Cycle Timer

Hermetically sealed miniature repeat cycle timer. . . .These timers are supplied in a 2½ in. diameter aluminum housing. They are motor driven and can be supplied with 50, 60 or 400 cps a-c motors or standard or governed d-c motors. An intercam reduction can be provided to allow high speed pulsing with an extended cycle time. A wide range of basic speeds are available, and intercam reductions up to 960:1 can be incorporated. These units can be supplied with flange mounting or three stud mounting; also with an AN connector or a glass-metal header.

Manufacturer—A. W. Haydon Co., 230 N. Elm St., Waterbury, Conn.

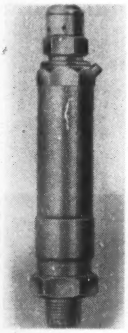
EQUIPMENT DEVELOPMENTS

Continued

Automatic Chamber Vents

"Duovent" automatic chamber vents designed to increase the efficiency of baseboard and convector hot water heating systems by creating a high point for collection of air. . . .Automatic venting is factory-set. It is intended to eliminate the need for several joint connections and nipples. Made in three sizes, they measure 2 3/16 in., 2 5/8 in. or 3 3/8 in. from the bottom of the hex to the top of the valve.

Manufacturer—The Keeney Mfg. Co., 1170 Main St., Newington, Conn.



Vent

Filter

Filter for Steam Boilers

Filter for use on steam boilers, evaporative condensers, and cooling towers. . . .Known as the "Fil-Ter-All," it is built in seven sizes, from six to 200 gph capacity.

Manufacturer—Austin Engineering & Mfg. Co., Inc., 8935 San Jose Rd., Ysleta, Texas.

Extension Wires

Addition of three types of extension wire to the company's line. . . .The new types are: a 14 gage extension wire with asbestos or waterproof insulation; a 14 gage chromel-alumel wire also with asbestos or waterproof insulation, and a 20 gage chromel-alumel extension wire with waterproof insulation. The 14 gage types which are used with iron-constantan thermocouples were withdrawn from production in 1951. The 20 gage wire has been designed for use in restricted space areas. In the 20 gage type, each conductor is coated with polyvinyl chloride, 1/64 of an in. thick. Both conductors are covered with cotton braid impregnated with an asphaltic base. Yellow designates the positive conductor and red the negative.

Manufacturer—Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44.

Showing the Step-by-Step Construction of Therm-O-Tile

REG. U.S. PAT. OFF.

Underground Steam Conduit

Referring to the photographs, Step 1 shows how the rigid 4-inch base of concrete is poured directly into the trench bottom. This furnishes a permanent immovable foundation on which the piping and conduit rest independently of each other. There can be no sagging or formation of condensate pockets with such a base as this.

Step 2 shows the Pipe Supports in place. This is quickly and easily done because of the "sidewalk" on which the men work.

Step 3 shows the piping in place — also quickly and easily done. Labor cost is kept low. No interference between different groups of mechanics thus permitting work of the highest quality.

Step 4 shows the insulation in place.

And finally, Step 5, the Base and Arch Tile are installed.

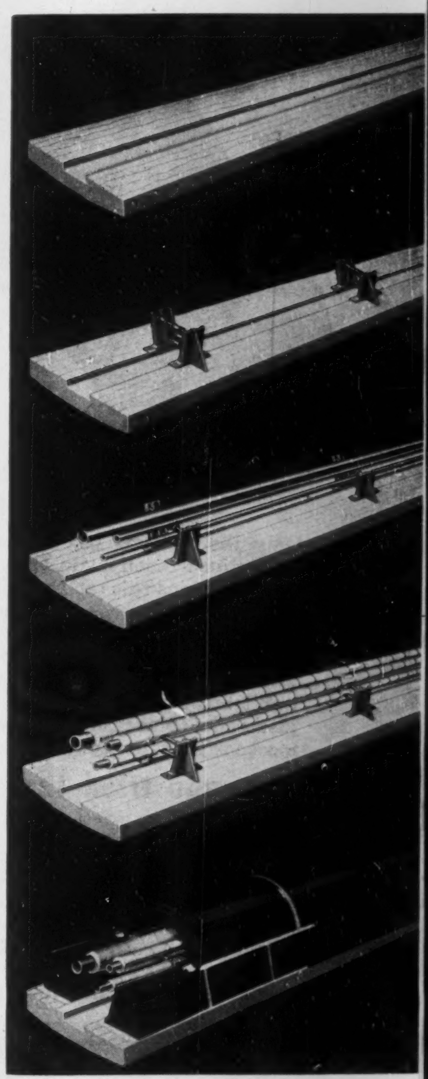
These five operations, all performed under ideal conditions, assure a highly efficient and economical conduit installation.

ASK FOR DATA.

Bulletin 511 gives complete construction details, uses, and shows typical installations.

JOHNS-MANVILLE

Therm-O-Tile is represented by Johns-Manville Technical Service Units in all principal cities.



H. W. PORTER & CO., INC.

822-H Frelinghuysen Avenue • Newark 5, N. J.

REID HAYDEN, INC.

BALTIMORE, MD. RICHMOND, VA. CHARLOTTE, N. C.

Insulation Engineers & Contractors

For Tops in Pipe Wrench Performance... it's the Genuine RIDGID

If this Housing ever Breaks or Distorts we will replace it Free
RIDGID
HEAVY DUTY
14
Every RIDGID Wrench Work-TESTED at the factory

...with the guaranteed trouble-free housing!

Only the RIDGID has a world-wide rep as the finest pipe wrench made. Only RIDGID has earned and maintains this rep by building toughness and smart performance into these overwhelmingly popular wrenches, checking them part by part and *hard work testing every last one* before shipment. When you buy a RIDGID, you know the housing won't break, the jaws won't slip or lock, the adjusting nut spins easily to all sizes, 6" to 60". Always most for your money—ask your Supply House.

Have you tried the new RIDGID Spud Wrench?

Deep narrow jaws for close work—breakproof housing—famous RIDGID jaw suspension—comfort-grip I-beam handle. Ask your Supply House.

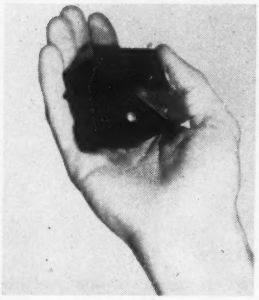
THE RIDGE TOOL COMPANY, ELYRIA, OHIO, U.S.A.

RIDGID
Work-Saver Pipe Tools

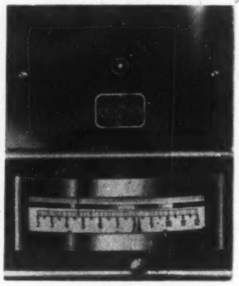
Motor Starting Relay

Motor starting relay designed specifically for single-phase capacitor start. and capacitor-start capacitor-run fractional or integral horsepower motors. . . .The manufacturer states that it is particularly applicable where adverse atmospheric conditions exist or where it is desired to have remote control incorporated into an explosionproof case. Calibrated at the factory to pick up at a pre-determined voltage, the relay coil is wired across the starting winding of a single-phase motor. In operation, the relay picks up only when the motor comes up to speed, increasing the induced voltage in the starting windings. Known as the "Type ARR-1," it is available in ratings up to 5 hp, 115/230 volts.

Manufacturer—General Electric Co., 1 River Rd., Schenectady 5, N.Y.



Relay



Controller

Electronic pH Controller

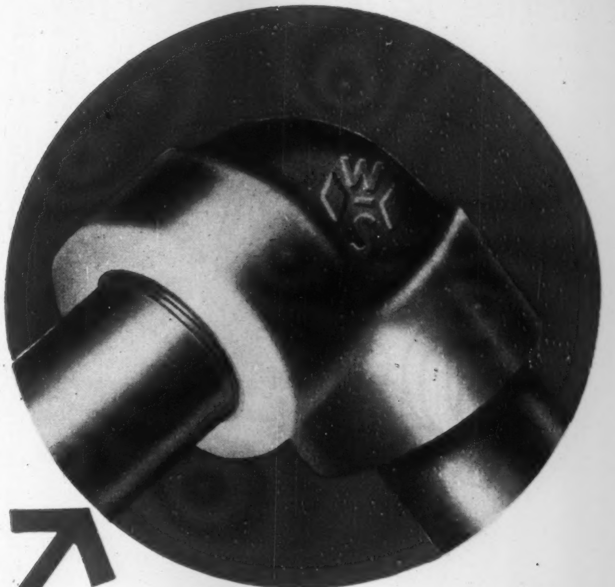
Electronic indicating pH controller with a variety of electric control actions. . . .The instrument has a high torque, jeweled, millivoltmeter type movement, a 7 in. mirror scale, and a dust and vapor proof case. It is available in the following electric control actions: two position, two position with normal zone, two position with proportional input, and three position control. The company states that it will actuate a wide variety of final control devices, permitting pH control with any type of reagent—liquid, gaseous or solid.

Manufacturer—The Bristol Co., P. O. Box 1790, Waterbury 20, Conn.

Slide In Radiator Panels

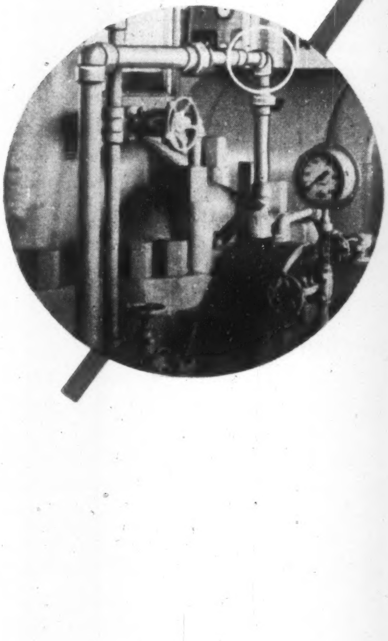
Convector radiators with slide in front panels. . . .The panels are available on "Type F," "FE" and "FB" convector radiators. The manufacturer states that installation time is cut because drilling, hand fitting and driving screws are eliminated.

Manufacturer—Fedders-Quigan Corp., Dept. NR, Hancock & Lalor Sts., Trenton 7, N.J.



CLOSE-UP VIEW of a HIGH SAFETY FACTOR

Against Costly Piping Failures



In power plants, chemical plants, refineries and other systems operating at high pressures and temperatures, W-S Forged Steel Fittings help protect the large investment in operating equipment. They provide a high safety factor against costly piping failures and plant down-time. They're drop-forged for *high strength* and *toughness*—the right combination of properties to withstand pressure, heat, shock, vibration and erosion. They're designed for extra strength, too—with extra heavy sections where you need them. And they're precision machined for perfect alignment.

Make Watson-Stillman Forged Steel Fittings your standard for safe, reliable operation of plant equipment. To suit any service and fabrication requirements, W-S Fittings are available in both Screw-End and Socket-Welding types in carbon, stainless and alloy steels. Write today for informative bulletins.

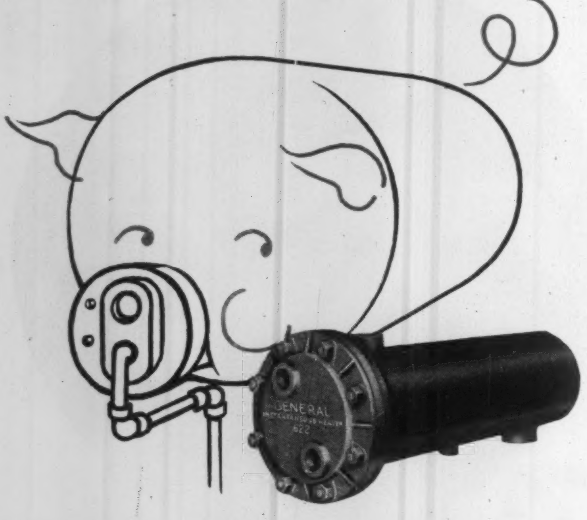
Sold Through Leading Distributors

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

Roselle, New Jersey

Replace Your "Floor-Hog"...



... with a modern water heating system

Install a compact
GENERAL
Instantaneous Heater

HERE'S A DEPENDABLE, continuous water heating unit you can install in a fraction of the space required by storage tanks of equal capacity. The largest of 20 GENERAL Instantaneous Heaters available measures only 21" x 84" . . . and delivers 300 g.p.m. of piping hot water! You can even install them overhead, completely out of the way.

They cost less, too . . . less to buy, install, and maintain. Just tap a General Instantaneous Heater into existing live or exhaust steam lines . . . no excavating, no complicated piping. Seamless copper tube, and bronze head and tube plate construction assure years and years of rust-free performance . . . a GENERAL Instantaneous will out-live all other water heating systems!

Whether you intend replacing your old water heating system, or expanding it, investigate all the advantages of GENERAL Instantaneous Heaters. Write, wire, or call for complete details. General Fittings Co., Dept. A, 123 Georgia Ave., Providence 5, R. I.

GENERAL
FITTINGS
COMPANY
GF
INSTANTANEOUS WATER HEATERS

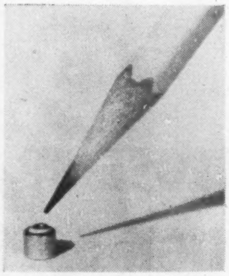
EQUIPMENT DEVELOPMENTS

Continued

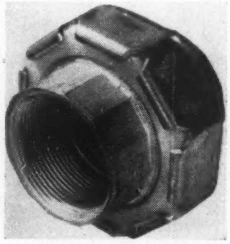
Miniature Thermal Switch

"MiniTherm," a chemical type thermal switch 3/16 in. in diameter and 3/16 in. long . . . .Below a predetermined switching temperature the resistance of the switch exceeds 10 megohms, the manufacturer says. When it reaches its switching temperature, the resistance is said to become permanently less than 0.10 ohm. Current rating is 5 amps, a-c or d-c, continuous duty. The units are available at switching temperatures from 150 to 400 F in increments of 25 deg, and from 400 to 1000 F in increments of 50 deg. It is designed to operate under great vibration or shock.

Manufacturer—MiniTec, 5423 Delaware Ave., Los Angeles 41.



Thermal Switch



Pipe Union

Insulating Pipe Unions

New sizes, from ½ in. to 2 in., in insulating or dielectric pipe unions, which serve as pipe unions and electric circuit breaks to stop the flow of stray electric current . . . . According to the company, these unions afford protection against galvanic corrosion and electrolysis in piping systems where any two dissimilar metal pipes are connected. The heart of the union is the insulating nut of zinc plated steel shell containing a nylon core. The unions are applicable for gas, water, steam and all types of fluids.

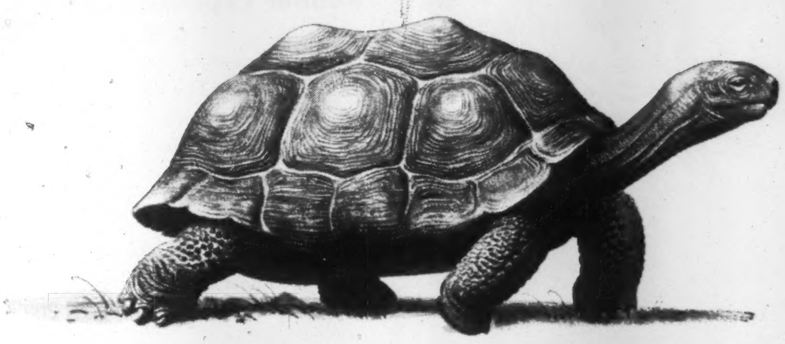
Manufacturer—Universal Controls Corp., 731 W. Davis St., Dallas 8, Texas.

Heat Transfer Surface

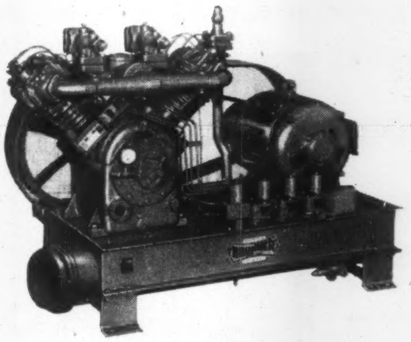
"Monofin" heat transfer unit, a plate type fin and round tube core, made up of seven fins per in. . . . The manufacturer states that it has greater heat transfer contact surface. The units are adaptable for engine cooling and for cooling oil, gas, compressed air, and for air conditioning, heating and cooling functions. They are available in copper, brass, admiralty, aluminum, or steel tubes and copper or aluminum fins.

Manufacturer—Young Radiator Co., 709 S. Marquette St., Racine, Wis.

in air conditioning, too...



SLOW SPEED *means* LONG LIFE



BRUNNER CONDENSING UNITS

— for remote installation in commercial and industrial air conditioning applications are available in sizes up to 75 H.P. Brunner Compressor Units for use with evaporative condensers also available up to 75 H.P.

SELF-CONTAINED AIR CONDITIONERS

—completely packaged, easy to install and operate, are supplied in various models in sizes 2 H.P. to 20 H.P. — for residential and commercial use.

Why does the turtle live so long?

From an engineering viewpoint, the answer would probably be "Slow Speed!" Because the speed with which things *move* has a vital effect upon their life and usefulness, the design engineer is *always* concerned with doing *more* work with *less* motion.

Famous BRUNNER slow-speed COMPRESSORS are good examples of this principle. Because they operate at speeds much slower than other compressors of the same capacities, Brunner Compressors deliver full capacity air conditioning with *less* costly motion—*less* wear on working parts, *less* maintenance required — and *lower* operating costs, too.

That's *one* good reason so many architects and consultants specify Brunner equipment on every air conditioning job — for utmost dependability, economy and long-range customer satisfaction. There are *other* reasons, too — so why not get the complete Brunner story? See your Brunner representative — or write us.

BRUNNER MANUFACTURING CO. Dept. L-94 **UTICA, NEW YORK**
The Brunner Co., Gainesville, Ga.
In Canada: Brunner Corp. (Canada) Limited, Toronto, Ontario

BRUNNER BRUNNER SINCE 1906 *means dependable* air conditioning

Mueller Climatrol
TYPE 160
GAS UNIT HEATER

NEW! New design, new efficiency. A.G.A.-approved for natural, manufactured, mixed, and propane gas.

MORE EFFICIENT! Designed for real heating economy — longer life, minimum maintenance.

EASY TO INSTALL! Shipped pre-wired and pre-assembled. Easy to hang.

. . . EIGHT SIZES FROM 50,000 TO 225,000 BTU INPUT IN INCREMENTS OF 25,000 BTU

Any way you look at it, this Mueller Climatrol has what it takes to help you fill the bill for unit heater applications of the unit-heater business in stores, garages, factories and other commercial establishments. Check these features:

Compact — only 29½" x 19½" x 12" (for the 50,000 Btu size.)

High Crown Sheet — no "hot spots", no joints or welds exposed to flame.

Welded-Steel, Air-Tube-Type Heat Exchanger — for maximum heat extraction, efficiency, *longer life*.

Quiet Fan — propeller type, properly pitched for even air distribution.

Cast-Iron Drilled-Port Burner provides even heat distribution over entire hearth area.

Built-In Diverter with rear flue outlet — adjustable louvers. Enclosure for burner and controls is optional.

Smooth Finish in cool Mountain Spring Green color, easy to repaint to match room decor.

These and many other features add up to ready acceptance of the Mueller Climatrol Type 160 Unit Heater by engineers, architects and builders.

Write for facts and figures that tell you more about this newest Mueller Climatrol.

Mueller Climatrol 97th Anniversary D-152B
2023R W. Oklahoma Ave. • Milwaukee 15, Wis.

EQUIPMENT DEVELOPMENTS

Continued

Rubber Expansion Joints

Rubber expansion joints for installation on new or existing metal piping and other equipment. . . .The manufacturer states that the joints provide compensation for expansion and contraction, and eliminate vibration and resultant sounds. They are available with standard right-angle ends or the company's patented "Flang-Lok" ends. The flange style has rubber or neoprene connecting faces to give a non-metallic seal. Both joints are designed to handle almost all gases and fluids under pressure or vacuum, at temperatures up to 200 F. Sizes range from ⅜ in. to 96 in.

Manufacturer—Goodall Rubber Co., 10 Whitehead Rd., Trenton 4, N.J.

Float Trap

"No. 81" float type moisture trap for air, gas and steam applications. . . .Designed for operating pressures up to 200 psi, the trap is suitable for draining moisture and condensate from piping systems. There is an optional inlet for ease of installation. The trap consists of a stainless steel valve and seat, lever, and a copper hide float inside a cast semi-steel case. The valve is opened by liquid raising the float, and closed when the float drops the liquid level. Connections are either ½ in. or ¾ in.

Manufacturer—The V. D. Anderson Co., 1935 W. 96th St., Cleveland 2.

Midget Solenoid Valves

New series of midget solenoid valves for handling all types of gases and liquids . . . . The valves have a soft seat, tight shutoff construction and are multipurpose, the manufacturer states. Among the groups are time delay valves, manual reset valves, two way on/off and three way valves. Individual valves are designed to handle gas, oil, air, water and corrosive fluids. Aluminum, brass or stainless steel is used as the body metal to suit the application.

Manufacturer—General Controls Co., 801 Allen Ave., Glendale, Calif.

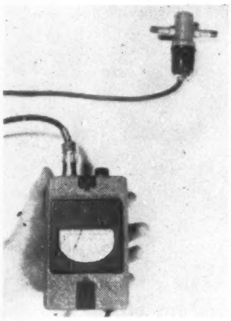
EQUIPMENT DEVELOPMENTS
Continued

Fuel Unit Tester

Portable fuel unit tester designed to simplify oil burner servicing and to facilitate pump repairs.... The manufacturer states that an operator using the tester can discover sources of fuel unit or pump trouble and determine whether full efficiency can be restored. It comes furnished with a pump flange, reversible 1/3 hp motor, U. S. gages, pressure fuel lines, quick couplings, adaptors, a parts catalog and complete instructions.

Manufacturer—Kingsley Mfg. Co., New Haven, Conn.

Electronic Flowmeter



Electronic flowmeter for direct readings of gas flow in 50 to 10,000 cc per min range from an indicator small enough to be held in the palm of the hand. . . . It is designed for applications such as process control and quick line checks. A directly heated thermocouple gage tube can be placed in line for low flow rates with almost no pressure drop in the line, the manufacturer says. The unit may be used with a long extension cable for remote indications. Logarithmic calibration provides ease of reading in low flow ranges. The reported response time is ½ second. The instrument may be calibrated for measurement of mass flow in pounds of air or gas.

Indicator unit is housed in a 27 oz all-metal case, which is 3½ in. × 5½ in. × 2½ in.

Manufacturer—Hico Instruments Div., Hastings Instrument Co., Warwick, Va.

take no less than these
TOP PERFORMANCE STANDARDS
for M&L FUEL OIL HEATERS

- Expert design by experienced heating engineers
- Carefully selected from a wide range of construction materials
- Full protection against corrosion
- M & L Guarantee against defects in workmanship and materials

You can be sure of all these if you specify a
M & L FUEL OIL HEATER

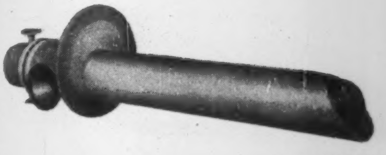
There's a type for every fuel oil heating need—commercial or industrial.

They meet the standards of the Fuel Oil and Water Heater Manufacturing Association.

Send for our complete catalog including data on the new M & L Fuel Oil Guardian Heater (832-52-SA).*

*New York City Approval No.

"U" TUBE 2 OR 6 PASS TYPE HEATER



TANK OUTLET OIL HEATER

Manning & Lewis Engineering Co.
M&L
32 Ogden Street Newark 4, New Jersey
SALES REPRESENTATIVES IN PRINCIPAL CITIES

Architect Stanley Brown, A.I.A. gives

10 Good Reasons

why he specifies

Janitrol

Since 1945, Mr. Brown of Dallas has designed over 50 school buildings, all using Janitrol Gas-Fired Unit Heaters, here are his reasons . . .

1. Janitrol units have met with the approval of every client.
2. They are economical in first cost and require a very minimum of maintenance.
3. Ceiling suspended, they occupy no valuable floor area.
4. Installation provides absolute safety for school children.
5. Thermostat control assures good heat at the right place and at the proper time regardless of outside weather conditions.
6. Blower fan is often used as air circulator in summer.
7. Classrooms can be heated very quickly.
8. Forced-air heat gives a good distribution of warm temperatures.
9. Heaters are compact, with a pleasing appearance.
10. Janitrol Unit Heaters have been satisfactory in every way and the service given by your distributors has been excellent.

Janitrol
GAS-FIRED UNIT HEATERS

Janitrol Heating
& Air Conditioning Division
Surface Combustion Corporation
Columbus 16, Ohio
In Canada: Alvar Simpson Ltd.
Toronto 13

ALSO MAKERS OF **Surface** INDUSTRIAL FURNACES **Kathabar** HUMIDITY CONDITIONING

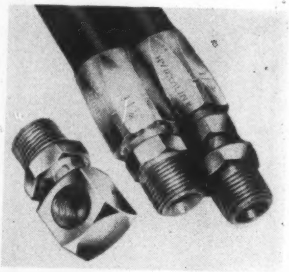
Forged Steel Gate Valves

Stronger wedges, stem to wedge connections and a union bonnet are features of newly designed forged steel gate valves. . . .The wedges are made of 13 percent chrome stainless steel for corrosion resistance. The stem to wedge connection is designed for increased pull out strength and to distribute the pull out load throughout the wedge structure. In the union bonnet construction, a body to bonnet joint of male-female type provides a recess for the gasket, seating it securely and reducing the possibility of leakage or blown gaskets.

Manufacturer—The Ohio Injector Co., 275 Main St., Wadsworth, Ohio.

Reusable Hydraulic Couplings

Reusable high pressure, hydraulic couplings for hose assemblies. . . ."Hydralink" couplings are available in a standard range of sizes for both one and two wire braided, rubber covered hoses.



Both fixed and swivel male end couplings are available. They are engineered for on the job installation. The company also is producing a 90 deg "swivel elbow" designed for high pressure hydraulic equipment. The company states that the elbows can be adjusted to any angle in their relationship to the other connections.

Manufacturer—Condamatic Co., Inc., Sales Export Div., 332 W. 21st St., New York.

Name Plates for Air Conditioning Use

Metal name plates available from stock for identifying air conditioning and refrigeration components including controls. . . .The plates are $2\frac{1}{2} \times \frac{3}{4}$ in., are made of metal with a black enamel finish and raised natural aluminum letters. There are more than 100 standard refrigeration and air conditioning wordings listed for immediate shipment. The name plates are designed to conform to refrigeration and electrical code requirements.

Manufacturer—Seton Name Plate Co., Dept. HB, 394 Central Ave., New Haven, Conn.

PRUDENTIAL— AN EXAMPLE OF AIR CONDITIONING AT ITS BEST

Yes, there is a difference in air conditioning, just as there is in heating, automobiles, housing . . .

True comfort means maintaining BOTH HUMIDITY and temperature at optimum levels.

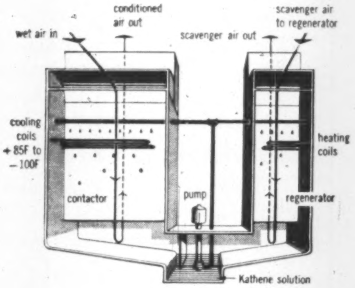
The Prudential Insurance Company of America has the right idea . . . direct dehumidification for humidity control, conventional cooling for temperature control. Here's how. Kathabar units continuously dehumidify a supply of outside make-up air to a moisture level which absorbs the moisture load of the entire building. This is done economically, with cooling tower water.

The air then is sensibly heated or cooled as needed in tempering coils, located throughout the building. Since the air is dehumidified before cooling, the surfaces of these coils are *dry*. Result, no musty odors, bacteria at a minimum, health at a maximum.

It pays to buy the best when selecting air conditioning. The combination of Kathabar for humidity control and conventional refrigeration or well water for temperature control is simple, economical. It is creating new high standards in air conditioning throughout the country.

The team has been equally effective in many industrial process air conditioning applications where dry air and/or low temperatures are required. Literature group K-54-8—which includes our new brochure "Humidity Conditioning"—will give you the complete story.

WHAT COULD BE SIMPLER?



Air to be conditioned passes through the contactor, where an absorbent solution removes moisture (the amount depends on the automatically-controlled temperature of the solution). In the automatic regeneration, about 15% of the solution is heated, and the moisture it releases is blown out the window.

Kathabar®
HUMIDITY CONDITIONING

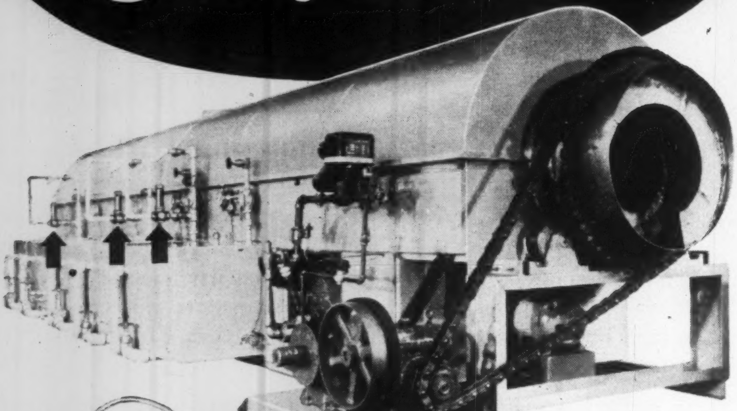
SURFACE COMBUSTION CORPORATION • TOLEDO 1, OHIO

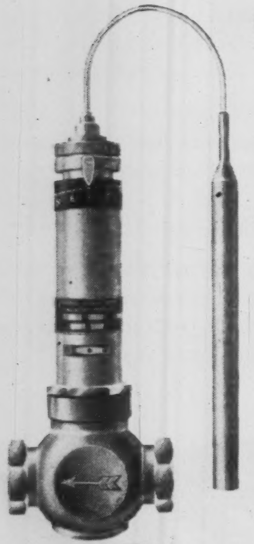
ALSO MAKERS OF **Surface** INDUSTRIAL FURNACES **Janitrol** AUTOMATIC SPACE HEATING

there are
2 sides to
real value . . .

HIGH CONTINUED PERFORMANCE
LOW CONTINUED COST

STĀCON
TEMPERATURE REGULATORS
give you both





For maximum efficiency, as well as economy, Metalwash Machinery Corporation, Elizabeth, N. J., manufacturers of spray washing and pickling equipment, installed three STĀCON temperature regulators on this rotating drum machine. STĀCON controls the temperature in the pickling, rinsing, and soap coating process. Because every component of their machinery must "measure up," Metalwash Machinery Corporation demands —and gets—real value. If that is what you want, specify STĀCON. Write for Bulletin ST. 162B.

Compare these features:
1 Tight shut-off
2. Rugged, field-replaceable thermostatic system
3. Instantaneous response
4. Simple adjustment
5. Minimum maintenance
6. Direct or reverse acting
7. Extremely compact
8. Self-acting

REPRESENTATIVES AND STOCK IN ALL PRINCIPAL
CITIES OF UNITED STATES AND CANADA

Farris **STĀCON CORP.**
465 Commercial Ave., Palisades Park, N. J.
Affiliates: FARRIS ENGINEERING CORP • FARRIS FLEXIBLE VALVE CORP
FARRIS HYDROTORQUE CORP. • FARRIS HYDROSEAL CORP. • FARRIS PICKERING GOVERNOR CO

EQUIPMENT DEVELOPMENTS

Continued

Horizontal Unit Heaters

New series of horizontal unit heaters designed to provide low outlet temperatures on high pressure, high temperature steam systems. . . . The manufacturer states that the propeller fan unit heaters can be used on steam systems of pressures up to 125 psi. Capacities of the units range from 385 to 5430 cfm (70 deg air), 17,400 to 228,000 Btu per hr (with 60 deg entering air and 2 psi steam pressure). The units are designed to be used with hot water heating systems also. All heaters are available with single or two speed motors.

Manufacturer—American Air Filter Co., Herman Nelson Products, 215 Central Ave., Louisville 8, Ky.

Btu Recorder-Controller

Continuous measurement and control of rate of heat input or output accomplished with the use of the "Dynamaster" Btu recorder-controller system. . . It can be used to measure and record the quantity of heat supplied to or drawn from process vessels, refrigerating plants, air conditioners and other heat exchanging devices. In the basic system, one "Dynamaster" measures the temperature difference with two resistance thermometer bulbs and receives the flow-rate from a flow transmitter. From the two variables, it continuously computes and records the Btu products, the company states.

Manufacturer—The Bristol Co., P. O. Box 1790, Waterbury 20, Conn.

Deaerating Heater

Principles of spray and tray deaeration incorporated into "Spray-Tray" utility deaerating heater. . . . The heater is designed for high pressure feedwater cycles of central station plants where the steam pressure or load on the heater fluctuates with turbine pressure. In operation, the inlet water, regulated by an air operated control valve passes through the internal vent condenser consisting

EQUIPMENT DEVELOPMENTS

Continued

of a cluster of stainless steel, self adjusting spray valves. The water is sprayed into an atmosphere of steam and then falls on distributing pans. From these pans, which distribute the water across the heater, the water flows to trays.

Manufacturer—Graver Water Conditioning Co., 216 W. 14th St., New York 11.

EQUIPMENT BRIEFS . . .

SUMP and LINE FILTERS for use in the filtration of non-flammable hydraulic fluids. . . .The new filters retain the manufacturer's basic "Synclinal" design which provides for proper balance of filtering area and storage capacity for filtered out particles. Capacities range from 5 to 100 gpm.

Manufacturer—Marvel Engineering Co., 625 W. Jackson Blvd., Chicago 6.

ATOMIC RESEARCH REACTORS adapted for use in training personnel for the nuclear power industry and for conducting basic nuclear research and development. The designs of two models are modified versions of the declassified "water boiler" and "swimming pool" reactors developed by the AEC.

Manufacturer—Babcock & Wilcox Co., Atomic Energy Div., 161 E. 42nd St., New York 17.

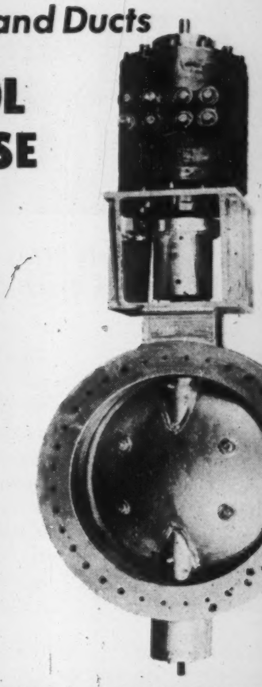
AIR CONDITIONING BAFFLE made of molded "Fiberglas". . . .The material is made by molding uncured "Fiberglas" under heat and pressure to form an object of the desired shape and density. Its thermal and acoustical insulating properties make it adaptable for air baffles.

High density Fiberglas is nearly 100 percent glass with only a small amount of binder, the manufacturer says. Curing of the thermosetting binder gives it structural integrity while the density depends upon the amount of pressure applied.

Manufacturer—Owens-Corning Fiberglas Corp., 1911 Nicholas Bldg., Toledo 1.

A Boon to Your Pipe Lines and Ducts

- **POSITIVE CONTROL**
- **INSTANT RESPONSE**
- **TIGHT SHUT-OFF**



This W. S. Rockwell 30" cast steel Butterfly Valve, with stainless steel rim on valve disc for corrosion resistance, handles air and hydrocarbon exhaust gases at 50 p.s.i. and 350° F. maximum temperature. It is operated by a heavy duty hydraulic rotary cylinder.

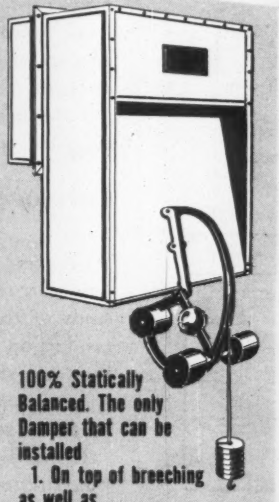
W. S. Rockwell Valves are made in sizes to 132", of any metal or rubber-lined with any automatic or manual operator. They are designed to meet required operating conditions at temperatures to 2000° F. and pressures to 300 p.s.i. and higher.

ROCKWELL SINCE 1888 BUILT

W. S. ROCKWELL COMPANY

BUTTERFLY VALVES • SLIDE VALVES • AUTOMATIC VALVES

2544 Eliot St. • Fairfield, Conn.



100% Statically Balanced. The only Damper that can be installed
1. **On top of breeching as well as**
2. **On side of breeching**
3. **Under breeching**
4. **At base of chimney**

Approved by Underwriters' Laboratories, Inc.

It's Basic for Every Combustion Specification

PREFERRED

Barometric

DRAFT-A-JUSTOR

As Important for Top Boiler Performance as the Burner Itself

Your fuel metering equipment in a combustion system is no better than the system's draft control equipment. Preferred Draft-A-Justors have proved in thousands of installations best by test—truly a must for heating economy.

- Saves 10-30% in Fuel
- Insures Uniform Draft
- Increases CO_2 Percentage
- Reduces Boiler Maintenance
- Ventilates Boiler Room
- Available in All Sizes

Specified by leading architects and engineers. Include Preferred Draft-A-Justors in your next heating specification—Write for Bulletin 800.

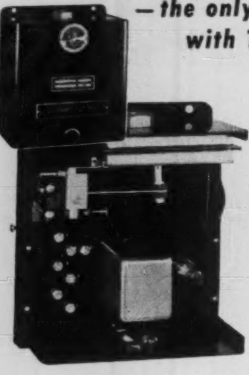
PREFERRED UTILITIES MFG. CORP.

EQUIPMENT FOR AUTOMATIC HEATING AND POWER

1860 Broadway • Dept. SH-3 • New York 23, N. Y.

NOW Complete Protection when Draft Fails without nuisance shut-downs from momentary puffs

CLEVELAND LO-DRAFT CUT-OFF

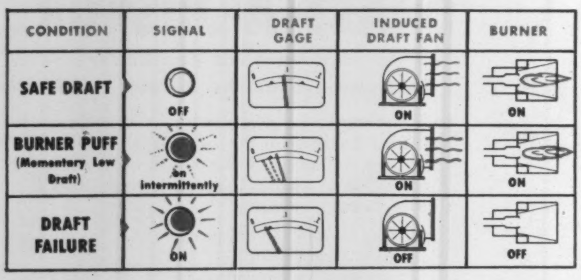


—the only "FAIL-SAFE" draft switch with TIME-DELAY FEATURE

This safety device is engineered specifically to prevent explosions or damage to boiler by automatically cutting off burner when draft fails, whether induced or natural. Only *Cleveland* LO-DRAFT CUT-OFF has all these features:

1. Sensitive enough to work from overfire draft for remote installation. Can also be installed at the breeching.
2. Cut-off point adjustable on the job—over complete range.
3. Time delay prevents momentary puffs from cutting off burner.
4. Standard unit interrupts low-voltage burner control circuit. Simple plug-in relay adapts unit for line voltage interruption.
5. Flexible diaphragm—laboratory tested to 100,000 operations without failure.
6. Signal light indicates momentary or sustained low draft.
7. Terminals provided for alarm or remote signal.
8. Hermetically sealed, plug-in time delay relay, self-compensating for ambient temperature.
9. Extra-sensitive, sealed switch with positive on-off action.
10. Absolutely *fail safe*. Failure of any component immediately cuts off burner.

LO-DRAFT CUT-OFF OPERATION



CONDITION	SIGNAL	DRAFT GAGE	INDUCED DRAFT FAN	BURNER
SAFE DRAFT	OFF		ON	ON
BURNER PUFF (Momentary Low Draft)	on intermittently		ON	ON
DRAFT FAILURE	ON		OFF	OFF

3 standard models available: Lo-Draft switch only, switch with time delay for interrupting low-voltage or line-voltage burner control circuit. Special units also provided for manufacturers' specific requirements.

COMBUSTION INSTRUMENTS & CONTROLS FOR EFFICIENCY AND ECONOMY

CLEVELAND FUEL EQUIPMENT COMPANY
1111 Brookpark Road, Cleveland, Ohio

RECENT TRADE LITERATURE...

Actuator Motor

A series wound, 25 watt miniature motor designed for uses as a driving element in low or high speed linear or rotary actuator applications is described in a new leaflet, Form SR-43. The motor is illustrated, detailed in dimensioned drawings, and its characteristics are defined.

Manufacturer—Dalmotor Co., 1395 Clay St., Santa Clara, Calif.

Aluminum Air Filter

Four page folder describes and illustrates a new all aluminum air filter. The construction of the filter is such that it stops matting and reduces inlet resistance, the manufacturer states. Included in the bulletin are specifications, applications and enlarged photographs and drawings showing precision cut openings with burred talons for holding the dirt, and the air scoops which force air into high turbulence. Charts show the results of tests with dust which had 18 percent lint in it.

Manufacturer—George Evans Corp., Moline, Ill.

Boiler Specifications

A booklet giving complete information on the Kewanee Reserve Plus Rating Plan has recently been published. It is titled *A Report to Those Concerned with the Specifications, Selection, Sale of Steel Firetube Boilers*. The booklet has been issued as part of a campaign by the firm for proper rating methods.

Published by—Kewanee-Ross Corp., 101 Franklin St., Kewanee, Ill.

Carbon-Steel Electrodes

Carbon-Steel Electrodes For Use With Inert Gas Shields is the title of an article which has been reprinted from the *Welding Journal*. It is a study of the properties of electrode weld deposits for production use in the welding of carbon steel by the inert gas shielded metal arc process. Pictures of weld specimens and numerous charts make this booklet a guide in selecting electrodes for any job.

Reprints are available from Air Reduction Sales Co., Div. of Air Reduction Co., Inc., 60 E. 42nd St., New York 17.

Chemical Feeder

A small feeder for metering, controlling, mixing and dispensing small quantities of liquid chemicals is illustrated in Catalog 70-50. Specifications, capacities, installation diagrams and applications are covered.

Manufacturer—Fischer & Porter Co., 149 Jacksonville Rd., Hatboro, Pa.

Clay Pipe

Special uses of "Screw Seal'" clay pipe for industrial installations are illustrated in a new four page bulletin. The clay pipe, with a plastic joint, is used for acid lines, fume ducts, brine disposal and gravity water systems, and soil lines, as well as heating and ventilating systems.

Manufacturer—Vitrified Products Div., The Robinson Clay Product Co., 65 W. State St., Akron 9, Ohio.

Condensing Units and Compressors

Catalog No. B-54 describes belt driven condensing units and compressors. Illustrations and specifications on standard air and water cooled models of electric refrigeration units are included. Data also is given on other models, such as combination air and water cooled units, gasoline engine drive models and truck type models.

Manufacturer—Copeland Refrigeration Corp., Sidney, Ohio.

Copper Welding Alloys

A four page, fully illustrated news sheet, Vol. 1, No. 11, TIS 2263, has been issued by the manufacturer on its newly developed copper and copper base welding alloys. Five new alloys are listed, each with distinctive properties and each designed for a specific purpose.

Manufacturer—Eutectic Welding Alloys Corp., 40-40 172nd St., Flushing 58, N.Y.

Corrosion Inhibitors

Film Forming Corrosion Inhibitors Also Aid Heat Transfer is the subject of Technical Paper No. 129. The paper contains many references to the protection afforded by filming amines and the reduction in maintenance costs secured through protection against corrosion. Filming amines function by forming a non-wettable film over the metal surfaces contacted, thus preventing corrosion.

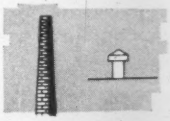
Published by—W. H. & L. D. Betz, Gillingham & Worth Sts., Philadelphia 21.

Dall Flow Tube

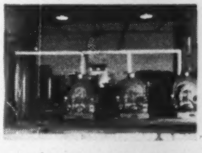
Technical Bulletin 115-L3 describes the new short differential producing metering device for the Dall flow tube. The bulletin includes information on recovery characteristics, accuracy, applications, range, flow formula, laying length and working pressure of the device. Also included are sections on installation, power consumption, effect of approach piping and fittings, and location of instruments.

Manufacturer—Builders-Providence, Inc., 345 Harris Ave., Providence, R. I.

It's not the
SIZE
that counts in
steam generation
It's the
SAVVY

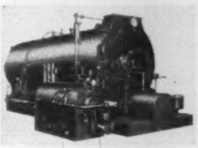


No Huge, Costly Stack. Only Simple Flue or Vent Required.



Factory-Tested Cyclotherm is shipped complete . . . with refractory, burner, control panel, etc. No other contractors needed.

Cyclotherm engineers will estimate your requirements. Servicemen immediately available at any hour.



Cyclotherm units range from 18 to 500 hp. . . . from 15 to 200 psi.

YEARS AHEAD IN STEAM GENERATION
CYCLOTHERM
STEAM AND HOT WATER GENERATORS

Cyclotherm Division
U. S. Radiator Corp.
Oswego, New York

The heat transfer rate of Cyclotherm's exclusive, patented Cyclonic Combustion is unequalled by any other method of combustion. Only 3 sq. ft. of heating area per boiler horsepower is needed . . . a bonus to you of 66% more steam generating power per sq. ft.!

Cyclotherm requires only two passes to reach a minimum heat transfer rate of 80%. Maintenance costs are reduced as much as 50%. The single pass of return tubes is easily accessible for cleaning . . . the combustion chamber needs no cleaning. The burner nozzle can be replaced in five minutes by any maintenance man.

Cyclotherm reaches its peak capacity faster . . . from cold start to full power in 15-20 minutes . . . and holds it steadily under extreme load conditions.

The flame is always perfectly controlled. Distribution is even throughout the furnace length . . . never impinging on the wall to cause hot spots and localized heat-retarding scale.

Cyclotherm is up to 1/3 smaller than any other packaged unit . . . 60% smaller in floor area than conventional boilers. Yet it delivers the same capacity . . . faster and more economically.

RETURN THIS COUPON TODAY

CYCLOTHERM DIVISION
U. S. RADIATOR CORP.
Dept. 226, Oswego, New York

...... Make a steam survey of my plant . . . without cost or obligation . . . and show me how I can get 66% more steam for my fuel dollar.

...... I am not ready for a survey, but please send me your illustrated folder explaining Cyclotherm's many advantages.

Name ....
Company ....
Address ....
City .... Zone .. State ......

Independent

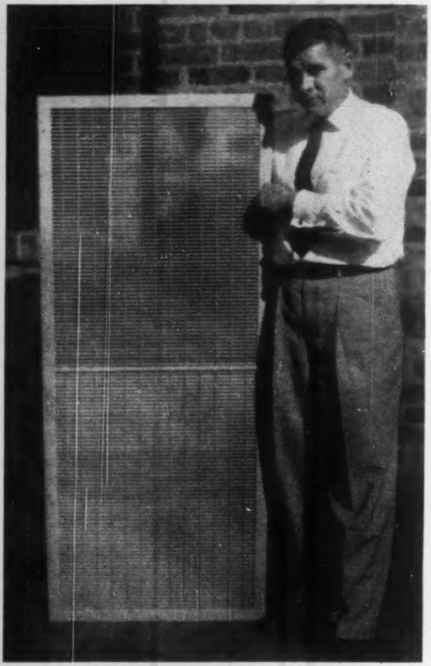
"Fabrikated"
REG. U. S. PAT. OFFICE
WALL GRILLES

Special Sizes to Your Order

We welcome your requirements for special, large size grilles. With Independent famous "Fabrikated" construction, such grilles are rigid—strong—exceedingly resistant to impact—the best money can buy.

On all such "specials" we are prepared to give immediate service and prompt shipment, since we always stock grille parts for any size.

Send us your requirements for prices and shipping date



This special "Fabrikated" wall grille is 4′ high and 2′ 10″ wide. We make 'em any size.

Always Leading—Always Progressing

THE INDEPENDENT REGISTER CO.
3747 E. 93rd STREET • CLEVELAND, OHIO

RECENT TRADE LITERATURE

Continued

Direct-Driven Fans

Detailed specifications, performance charts and dimension tables on the manufacturer's line of "MD" fans are contained in Bulletin MD-101. The bulletin explains the advantages of using direct-driven fans in various types of large buildings.

Manufacturer—Chicago Blower Corp., 9867 Pacific Ave., Franklin Park, Ill.

Electric Motor Control

Catalog 101 is a 140 page publication on electric motor controls. Primarily divided by major classifications, this catalog contains engineering and design data including wiring diagrams. Among the more than 2700 items listed are magnetic starters and contactors, combination starters, control panels, drum controllers, master, foot and pressure switches.

Manufacturer—Furnas Electric Co., 1041 McKee St., Batavia, Ill.

Exhaust Fans

Industrial Exhaust Fan Catalog No. 500-B features the "S-2" exhaust fan and descriptions of various applications, types and construction. Complete dimensional data and capacity tables are included to assist in application of the fan. Principles of application and engineering data for standard and long cone cyclone separators are described and illustrated.

Manufacturer—Fort Worth Steel and Machinery Co., P. O. Box 1038, Fort Worth 1, Texas.

Fan for Industrial Uses

The addition of a new fan to the manufacturer's line of heavy duty industrial fans is covered in Bulletin No. 2500. Included is a complete description of the construction and classes of the new "Type J" fans. Capacity tables are given for fan sizes from 12 in. diameter through 132 in. diameter. A performance curve indicates the general operating characteristics. The bulletin also contains dimension tables and photographs of typical fan assemblies.

Manufacturer—Robinson Ventilating Co., Zelienople, Pa.

Flexible Tubing

Industrial installations of "Flexaust" hose and of "Portovent" duct for moving air, dust, fumes, gases and materials are described in Bulletin No. 40. The bulletin illustrates such applications as sawdust removal, spot cooling or heating, air cleaner connections, abrasive dust collection, chemical fume exhausting, smoke removal, dehumidification, and air conditioning. Design details are included.

Manufacturer—The Flexaust Co., 100 Park Ave., New York 17.

Come to KEENEY — Headquarters for data to help with problems in

Heating, Piping & Air Conditioning

Only *Heating, Piping & Air Conditioning* magazine adequately covers all three fields each issue. Best evidence is last year's record:

250 feature pages on heating . . .
150 pages on Piping . . .
275 on Air Conditioning

675 pages, total . . .
or the equivalent of three books—plus 525 pages in outstanding departments and news.

- You'll get vital data on correct design, installation, operation, and maintenance—as applied to industrial, commercial, institutional and public buildings.
- You could make no better start toward solving your own problems in heating, piping and air conditioning than by knowing what successful engineers and contractors have done in working out similar problems. In HP&AC they discuss actual installations, procedures, equipment, objectives, and how specific problems have been met.
- Be better prepared in days ahead and have exactly that kind of help coming to you!

TO KEENEY PUBLISHING COMPANY

6 N. MICHIGAN AVENUE,
CHICAGO 2, ILL., U.S.A.

OK . . . Enter this subscription for HEATING, PIPING & AIR CONDITIONING

to start ________ or first possible issue — for term checked below, at special introductory U. S. rate of

☐ **3 Years, $6.00 (Saves you $3—the equivalent of 1 year FREE.)**

☐ **2 Years, $5.00 (Which saves you ONE DOLLAR CASH.)**

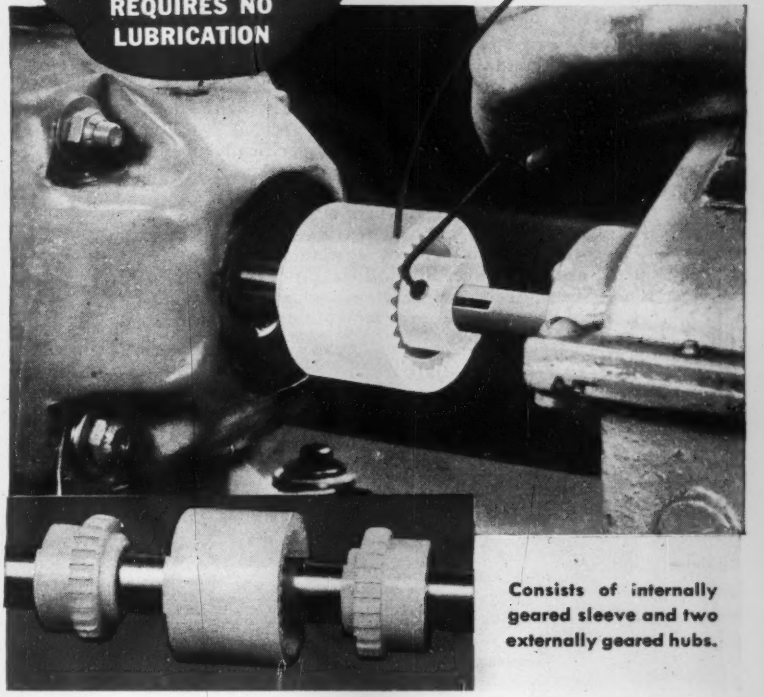
Check here ☐ for 1-year Trial for $3. in U.S.

To Canada and Pan American Postal Union, $4 a year; to other countries, $6 a year.)

(It in understood that this will bring me the 160-page Annual Buyers' Guide Directory of Equipment, Manufacturers and Trade Name Index in each January issue.)

☐ I enclose check for $. ☐ Send bill later.

My Name ________
Title ________
Function ________
Street ________
City ________
Postal Zone No. ________
State ________
Firm ________
Business ________



WALDRON

the new nylon COUPLING

NON-CORROSIVE
NON-MAGNETIC
REQUIRES NO LUBRICATION

Consists of internally geared sleeve and two externally geared hubs.

weighs 2¼ oz. . . . resists wear

Made of smooth, tough, durable nylon, this new WALDRON "Junior" Coupling provides many operating advantages and economies for smaller fractional H.P. drives.

Non-magnetic and non-corrosive, it is not affected by water, oils, most common chemicals and gases.

Because it requires no lubrication and has nothing to wear out, it is the most economical coupling you can use for longer service without maintenance or repairs.

Available in ⅜"—½"—⅝"—¾" nominal bores.

Write for full particulars, dimension tables, test data, etc.

A product of WALDRON—makers of the famous WALDRON Gear Type and Francke Pin Type Steel Couplings.

JOHN WALDRON CORP.
NEW BRUNSWICK NEW JERSEY

Sales Representatives in Principal Cities

NEW WEINMAN
type AC centrifugal pump
for air conditioning systems

When outside atmospheres are laden with abrasive dust particles, recirculation of cooling water in air conditioning systems using cooling towers becomes a major maintenance headache. Shaft seals become worn far more quickly than normal and leakage occurs.

The Type AC pump was designed specifically by Weinman engineers to render long service under these conditions; in addition to a rotary type mechanical shaft seal, there is provided a reversible ceramic floating seat and carbon washer combination held by a stainless steel spring, insuring longer life and leakproof operation. The shaft is solid stainless steel, preventing rust or corrosion even when cooling water is chemically polluted.

CLOSE-COUPLED

MOUNTS IN ANY POSITION TO FIT REQUIREMENTS

Wherever thoroughly dependable, trouble-free circulation of hot or chilled water, pressure-boosting, or other general pumping needs are indicated, Weinman Type AC pumps will give superior service. If you have a pump problem, call your nearest WEINMAN Centrifugal Pump Specialist or write for Bulletin 725 . . . perhaps the Type AC pump is exactly what you need!

Representatives in principal cities.

Built by Centrifugal Specialists
The WEINMAN Pump Mfg. Co.
286 SPRUCE STREET • COLUMBUS 8, OHIO

RECENT TRADE LITERATURE

Continued

Flow Control Valves

Technical Bulletin W8-A describes the new cushioned "Flowtrol" valve. This valve was designed to replace globe, angle, plug or gate valves that require manual opening and closing. The manufacturer states that one man can operate the valve to either the fully open or tightly closed position—when the value size is 2 in. or 36 in. or when the pressure in the line is 15 psi or 400 psi.

Manufacturer—Golden-Anderson Valve Specialty Co., 1210 Ridge Ave., Pittsburgh 33.

Hand Torches

Catalog ADC 702B covers the manufacturer's complete line of torches and tips for oxy-acetylene cutting and welding. Each standard torch and tip is listed along with the necessary mixers, extensions, adapters and accessories.

Manufacturer—Air Reduction Sales Co., Div. of Air Reduction Co., Inc., 60 E. 42nd St., New York 17.

Heating Systems, Steam Specialties

Five major types of steam heating systems, with and without control, and a full line of valves, traps and steam power specialties are described in Bulletin 110. The bulletin features the company's "Selectotherm" system, an automatically controlled high vacuum steam heating system that adjusts its heat output and fuel consumption to outdoor temperature and heat loss conditions. Also described are steam heating systems for installations that are zoned, that use steam for purposes other than heating, and that use steam supplied by central stations.

Manufacturer—Illinois Engineering Co., 2035 S. Racine Ave., Chicago 8.

Liquid Chillers

Air conditioning and refrigeration applications for "Flow-Cold" packaged liquid chillers are described in a new catalog. As examples of industrial application, brief histories are given on the use of these chillers for controlling solution temperatures in drug manufacture, for cooling welding tips and machine tool coolants, and for process cooling in the food industry. Its advantages as a central cooling source for air conditioning are discussed.

Manufacturer—Acme Industries, Inc., Dept. FC-50-C, Mechanic St., Jackson, Mich.

Mechanical Power Transmission

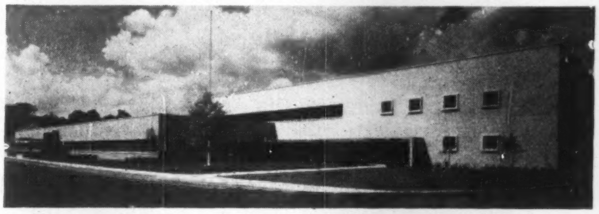
A newly revised eight page catalog, B20-53, describes a line of mechanical power transmission products. Described and illustrated are silent chain, roller chain and "Hy-Vo" drives; sprockets, cable chains, drive shafts, couplings and clutches. New

Control your air

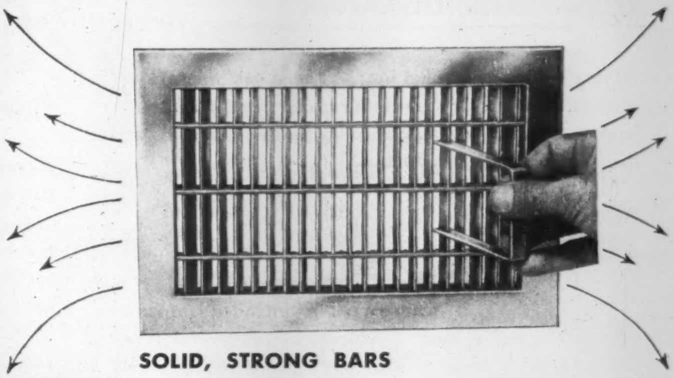
individually adjustable

2 way and 4 way air deflection

Designed for installation where quality and performance are of prime importance. They may be found in America's newest and finest schools, hospitals, and industrial plants. They have been installed recently in the new plant of Davis & Geck, Inc., manufacturers of sutures and surgical specialties, Danbury, Conn. (shown below).



Architect — Leo Caproni, New Haven, Conn.; Consulting Engineer (Heating and Ventilating) — Paul D. Harrigan, Hill & Harrigan, New Haven, Conn.; Contractor — G. R. Cummings Company, Meriden, Conn.; Gen. Contractor — H. Wales Lines Co., Meriden, Conn.



SOLID, STRONG BARS

1. Constructed of sturdy 14 gauge steel bars.
2. Fixed bars, single or double deflection.
3. Interlocking Cross Bars for Added Strength.
4. Finished in various types of electro-plating.
5. Bars adjustable only with special tool provided.
6. Tamperproof and Kickproof — Built to withstand abuse.

FREE Catalog on Request

Specify and Install R & G REGISTERS and GRILLES

Complete Line of Registers and Grilles for HEATING · VENTILATING · AIR CONDITIONING

REGISTER & GRILLE MFG. CO., INC.
70 BERRY STREET, BROOKLYN 11, N. Y.

Manufacturers' Agents...

Are you interested in securing additional lines?

We are occasionally asked by our manufacturer advertisers to suggest the names of manufacturers' agents in various sections of the country whom they can contact in regard to representation of their industrial and large building heating, piping, and air conditioning products.

If you would like your name listed on our records for inquiries we may receive on your territory, we invite you to write us. There is no charge in connection with this service.

HEATING, PIPING & AIR CONDITIONING
6 North Michigan Avenue Chicago 2, Illinois

information is included on "Taper-Lock" sprockets, cam clutches and torque limiting clutches. Brief specifications, stock sizes, applications and descriptions are included for each product.

Manufacturer—Morse Chain Co., 7601 Central Ave., Detroit 10.

Packaged Boilers

Brochure WT-7 includes information on operation and specifications of several types of packaged boilers built to meet steam requirements in the medium pressure range from 4100 to 30,000 lb of steam per hr. These units burn gas or oil or a combination of both. Engineering data and photos of these boilers are included.

Manufacturer—Wm. Bros Boiler and Mfg. Co., 1057 Tenth Ave., S.E., Minneapolis 14.

Plastic Valves

Plastic valves of unplasticized polyvinyl chloride are described in a new bulletin featuring both needle and globe valves. Also described is "Fluoroseal," a pipe compound suitable for plastic and metal piping. The company states that this compound provides a positive seal and retains its viscosity so that disassembly is readily accomplished.

Manufacturer—Industrial Plastic Fabricators, Endicott St., Norwood, Mass.

Pneumatic Controllers

Stack-type pneumatic controllers for process variables are illustrated with cutaway construction photos, schematic diagrams and dimension drawings in Catalog 53-10. Specifications, controller response actions, and a controller selection guide cover complete details of case mounted, field mounted and valve mounted control instruments.

Manufacturer—Fischer & Porter Co., 148 Jacksonville Rd., Hatboro, Pa.

Pressure Reducing Valves

Bulletin C-89 covers in detail various types of pressure reducing valves, lever and float valves, and strainers used for heating, ventilating and air conditioning. Each type is illustrated and applications, features and capacity tables are given.

Manufacturer—Fisher Governor Co., 205 S. First Ave., Marshalltown, Iowa.

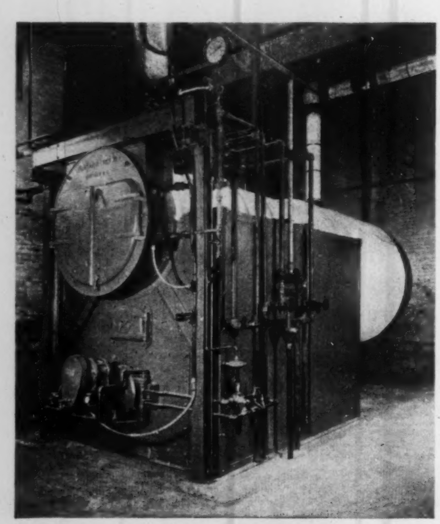
Pump Motor

New technical data sheet on the "ACEC" vertical hollow shaft pump motors provides complete information and illustrative diagrams on the

FARRAR & TREFTS, Inc.
ESTABLISHED 1863
20 Milburn Street Buffalo 12, New York

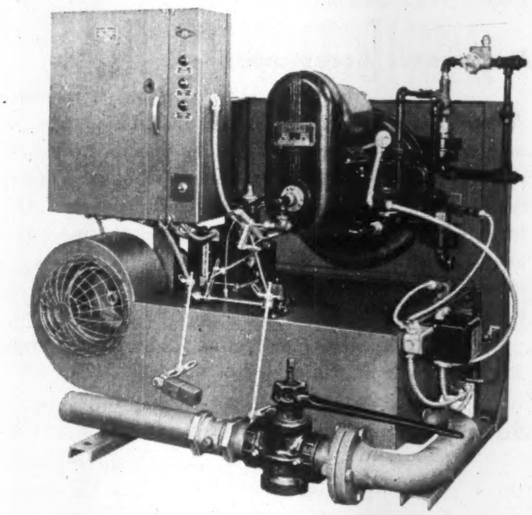
Streamline Welded BISON BOILERS Streamline Welded
FOR HEAT and POWER
Designed to produce maximum steam output in shortest time at minimum operating costs.
Scotch Wet Back Package Unit Boilers
Horizontal Return Tubular Boilers
Locomotive Type Boilers
Bison Two-Pass Refractory Lined Boilers
Scotch Marine Boilers
Scotch Dry Back Power Boilers
Utility Scotch Boilers
Bison Compact Boilers
Bison Firebox Boilers

ASME — API-ASME — LLOYDS
QUALITY BOILERS TO GIVE QUALITY SERVICE



BISON TWO-PASS BOILER

WEBSTER ROTONETIC*



DUAL FUEL FIRING BURNER

- √ Sizes from 75 to 300 horsepower.
- √ Minimum gas pressure requirements.
- √ Low installation costs.
- √ Maximum efficiencies on BOTH gas and oil.
- √ Minimum base height requirements.
- √ Utilizes all grades of fuel oil.
- √ Extremely low noise level.
- √ Approved electronic combustion safeguard system.
- √ Simpler changeover than ever before.
- √ One hundred per cent forced draft.
- √ Completely assembled, piped, wired and tested.

These and many other outstanding features combine to provide the same dependable high quality performance as the WEBSTER DYNETIC gas burner. Neither fuel must suffer if the WEBSTER ROTONETIC is used. With integral pumps, integral oil preheaters for heavy oils, patented oil burner "flame-shaping" vanes, and full modulating or optional high-low control, the WEBSTER ROTONETIC is designed to provide long lasting customer satisfaction the year around.

It is furnished with a precast refractory front as an integral part of the burner assembly. The installer need only finish the furnace wall on each side and above the burner.

Listed by Underwriters' Laboratories, Inc.

*TRADEMARK

Write for Literature

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

PROBLEM:
"We need a new heating system, but can't afford an expensive one."

SOLUTION:
"We saved $6000 by installing **Delta OIL-FIRED UNIT HEATERS** in our plant!"

"We had neither the space nor the funds to install a complex boiler system . . . and the cost of gas in this area was too high for our budget. So we struggled along with inadequate heating . . . until Delta direct-fired Oil Unit Heaters solved our problem. They're doing a big job at an unbelievably low cost!"

Delta DIRECT-FIRED OIL UNIT HEATERS

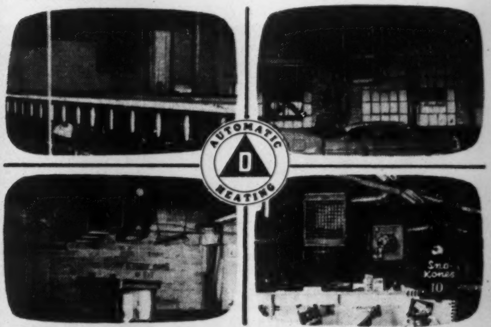
fit everybody's budget, everybody's needs.

SIMPLEST TO INSTALL: Big savings on installation costs. They need no large chimney, boilers, pipes, fittings. Factory wired and assembled . . . just hang them up.

LOWEST COST OPERATION: Delta's powerful pressure oil burner does a most effective and efficient heating job on low cost #2 fuel oil. Maintenance is simple and seldom. Costs 50% less to operate than old-style systems.

GREATEST COMFORT: Within seconds the Delta Unit Heater bathes the entire working zone with comfortable, even heat . . . with no cold spots, no overheating. Ten sizes from 112,000 to 220,000 BTU/hr. to meet all situations.

On your next installation, let DELTA OIL UNIT HEATERS solve all your price and performance problems. Write today for information.



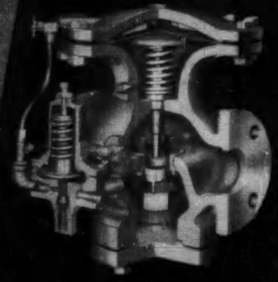
AUTOMATIC D HEATING

Delta HEATING CORPORATION
1 COLE STREET • TRENTON 8, N. J.

If it's...

McALEAR equipped

it's under **SAFE** control



One of the many McAlear Controls—No. 228 Pilot Operated Pressure Reducing Valve . . . accurately sensitive and dependable where positive and automatic control of reduced pressure is required in steam service.

● There's one thing you can be sure of in McAlear Controls and that's dependability . . . for infinite care and engineering exactness guard every step of McAlear manufacturing. And before a McAlear control is shipped for sale or use it is job tested for performance. That's why we say—"If it's McAlear Equipped it's under SAFE control." Write for descriptive literature today.

FOR EVERY CONTROL NEED
REMEMBER McALEAR

McALEAR
PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE
controls
for STEAM, WATER, AIR, OIL-GAS

McALEAR MANUFACTURING COMPANY
1901-1919 South Western Avenue
Chicago 8, Illinois

major dimensions of the motors. According to the company, the motors are suitable for deep well irrigation installations and industrial pumping applications.

Manufacturer—Dept. VHS, Belgian Electric Sales Corp., 40 E. 49th St., New York 17.

Pyrometer Accessories

Bulletin 4181, *"Alnor" Pyrometer Accessories*, is concerned with the installation, use and maintenance of pyrometer systems. Specifications and performance data for "Alnor" thermocouples of every type and application are thoroughly covered. Also included in the bulletin are notes on thermocouple alloys, temperature-millivolt relationship curves, a list of industrial applications, and a temperature conversion table.

Manufacturer—Illinois Testing Laboratories, Inc., 420 N. LaSalle St., Chicago 10.

Safety Program for Motors

A three-point electric motor safety check program is discussed in an article by several engineers at the Bakelite Co. The article deals with problems involved in selecting and keeping the right heaters, and testing overload relays as they apply to the company's electrical maintenance job. Included is a detailed description of overload relays, the precautions to be taken when installing and maintaining them, and a description of an advanced method for checking them by means of a new portable high current test unit.

Copies are available from the Multi-Amp Corp., 10 Third St., Newark 7, N.J.

Shaded Pole Motors

A new 10 page publication describes the manufacturer's complete line of shaded pole fractional horsepower motors for fan and blower applications. Designated GEA-6134, the bulletin illustrates features and applications of shaded pole motors with ratings from 1.5 watts through 1/6 hp and gives complete specifications, including dimensions and operating characteristics.

Manufacturer—General Electric Co., 1 River Rd., Schenectady 5, N.Y.

Snow Melting Systems

How Snow Melting Combats Winter Traffic Problems is the title of a 30 page report based on an analysis of snow melting systems in which water mixed with anti-freeze is circulated through wrought iron pipe coils or grids embedded in paved roadways. Included in the preface to the presentation of specific installations are a list of the advantages of snow melting and a discussion of construction and operational

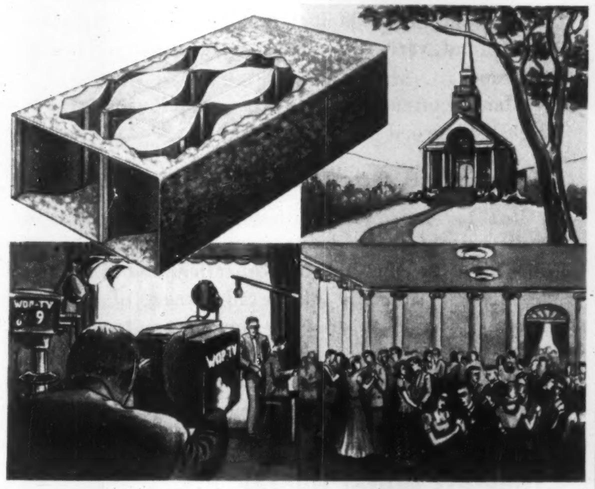
WHERE SILENCE IS AS IMPORTANT AS AIR CONDITIONING

specify *Aircoustat*

*Whatever the location of your next air conditioning installation . . . ballroom, TV studio, church, hospital, office building, store or plant . . . if **quiet** is required, Aircoustat offers the practical, economical solution to air conditioning noise!*

*This compact, **packaged** unit for silencing air and fan noise is easy to install. Incorporated as part of the duct work, it is attached by flexible connections . . . requires no special tools for installing.*

*Aircoustat produces **amazing** results. One **7 foot** unit, for example, reduces the noise level below what **100 feet** of old fashioned duct lining could accomplish . . . with low pressure drop. And selection is no problem. Aircoustat is so engineered that if it fits geometrically, it fits acoustically.*



Constructed of galvanized steel or aluminum, Aircoustats are available in 11 standard sizes for use with all styles and sizes of ducts, and in 3 types to meet any desired conditions.

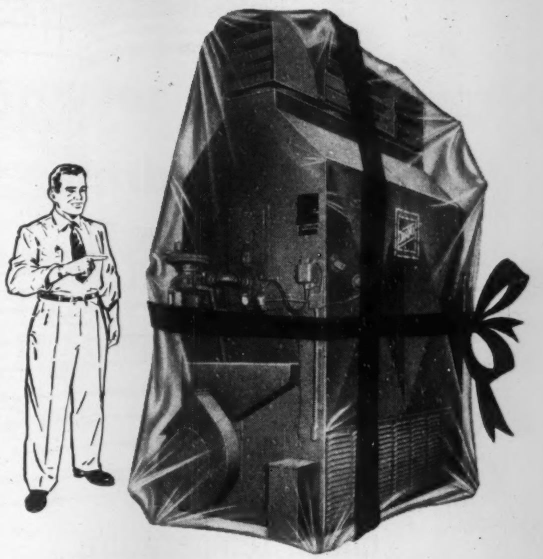
Write today for free descriptive literature.

SILENCE SERVICE

Industrial Sound Control Inc.
45 Granby Street, Hartford 12, Conn.

---

another DRAVO HEATER plus!



A complete package . . . ready to install!

Dravo Heaters are a complete package in every respect. No complicated assembly is necessary . . . no extra parts to purchase. To install, simply place the heater where you want it, connect the fuel—power—vent stack and your Dravo Heater is ready to operate!

The complete Dravo Heater package includes pressure regulators, burner, burner controls, forced draft and air supply fans, motor, thermostat, oil strainer, discharge nozzles, a heavy duty two-stage oil pump and all safety devices including electronic flame control.

A lot of these items are listed as "extras" on comparable type heaters, but on Dravo Heaters, they're standard equipment—part of Dravo's complete "packaged" heater.

Couple this feature with the many others offered by Dravo Heaters and you see why dollar for dollar, year for year, your best heating investment is Dravo Heaters.

MAIL THE COUPON

DRAVO CORPORATION, Heating Department
Fifth and Liberty Avenues, Pittsburgh 22, Penna.

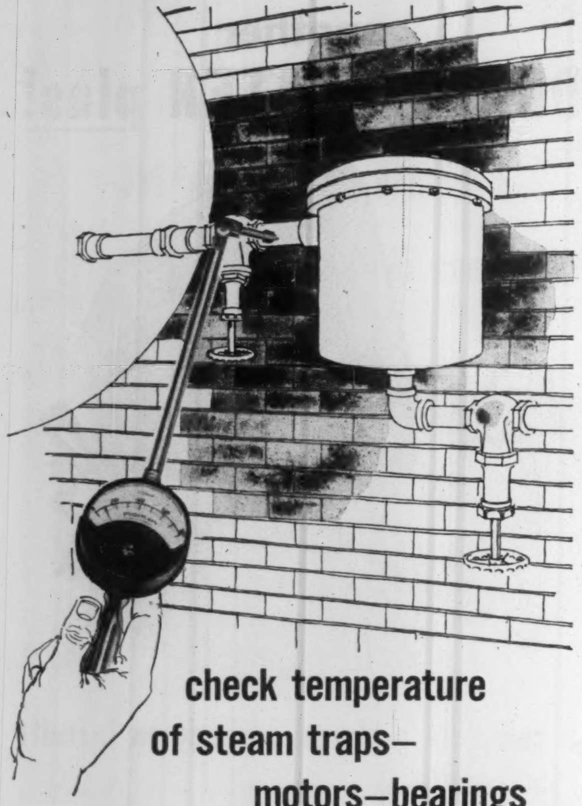
DRAVO

Please send me complete information about the Dravo:

☐ ***Counterflo* Space Heater** ☐ ***Paraflo* Space Heater**
☐ ***Gas Fired* Unit Heater**

☐ Please have a representative call at no obligation to me.
Ask for Bulletin HI 598-7980.

Name__________ Title__________
Company__________
Address__________
City__________ Zone____ State______



check temperature of steam traps— motors—bearings

. . . quickly and accurately with the Alnor Pyrocon, the portable contact pyrometer for taking surface temperatures. This handy, portable instrument can be your most useful maintenance and installation tool . . . it provides accurate temperature readings instantly of any surface (metallic or non-metallic), flat, curved, stationary or revolving.

It's a well-balanced instrument mounted in a sturdy case for protection against the usual hazards of on-the-job service. Jeweled movement is also heavy-duty, shock-resistant type that will withstand hard and continuous use . . . performing with laboratory accuracy.

A wide selection of thermocouples and extension arms assures its adaptation to your needs. Eight standard F. scale ranges are available up to 1200°F. Send for complete details contained in Bulletin 4257.
Illinois Testing Laboratories, Inc., Rm. 513,
420 N. LaSalle St., Chicago 10, Ill.

Alnor

PRECISION INSTRUMENTS
FOR EVERY INDUSTRY

costs. Much of the report is devoted to snow melting systems serving roads and highways. The last half of the report deals with off-the-street snow melting facilities.

Published by—Engineering Service Dept., A. M. Byers Co., Clark Bldg., Pittsburgh 22.

Stress Rupture Values for Tubing

Data card TDC 153-A presents stress rupture data on 11 tubing steels used in high temperature service. Included among these steels are carbon steel, intermediate chrome molybdenum steels and stainless steels. The data card is intended for engineers associated with the design of equipment operating under stress at high temperatures over long periods of time.

Published by—The Tubular Products Div. of the Babcock & Wilcox Co., Beaver Falls, Pa.

Structural Plastics for Industry

New bulletin, *Chemical-Proof Equipment News,* shows fabricated applications of "Rigidon," a glass reinforced plastic; "Rigidin," a rigid vinyl plastic; and "Rigidene," a plastic of polyethylene. The manufacturer states that these structural plastics are designed for applications in the chemical processing industry and are resistant to acid fumes and other corrosive conditions. Some of the applications shown in Bulletin No. 1053 include tank liners, ventilators, hoods and various types of rectangular and round ductwork.

Manufacturer—Heil Process Equipment Corp., 12901 Elmwood Ave., Cleveland 11.

Suspended Gas Heaters

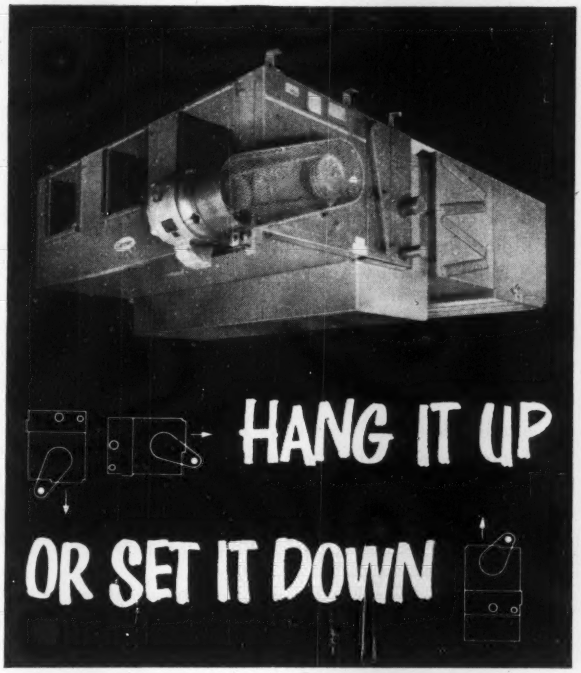
Full color illustrations of typical installations of suspended gas unit heaters are shown in a new six page bulletin. Other features of the bulletin are a summary of the advantages of gas unit heating, a cutaway drawing showing construction details, a special section on the company's venturi heat exchanger design, and complete dimensions and specifications.

Manufacturer—Reznor Mfg. Co., Mercer 8, Pa.

Tankless Water Heater

Four page brochure covers the "WH Series" self contained twin coil volume water heater line which delivers hot water through twin copper coils. The bulletin points out the advantages of the tankless hot water system and explains advances in volume water heating such as submerged twin coils, two temperature hot water, etc. Also included are dimensions and capacities for nine water heater sizes.

Manufacturer—Portmar Boiler Co., Inc., 193 Seventh St., Brooklyn 15, N.Y.



CARRIER HEATING AND VENTILATING UNITS are almost "as versatile as a one-man band." They can be horizontally suspended, vertically suspended, or floor mounted . . . in schools, auditoriums, gymnasiums, garages, mills, factories and other large-area buildings.

Sectionalized construction affords ease of installation. Flexibility in selection and applications. Right- or left-hand assembly. Horizontal, upward or downward air discharge.

And that isn't all: Carrier Heating and Ventilating Units can be used with or without ductwork. Multiple discharge outlets permit air distribution where needed, under all conditions of full or partial loads. Air temperature is always under positive control.

Flat or V-type filter sections may be chosen. Mixing sections can be incorporated in a variety of arrangements. Heating coils are available in a wide selection—for steam or hot water. Face and by-pass dampers are interconnected for ready control of heated air and by-pass air.

Other features, inbuilt or optional, testify further to the ingenuity of Carrier engineering. To the quality of Carrier manufacture. And to the dependable performance of these widely acclaimed units. Capacities range from 1500 to 30,000 cfm.

For complete list of features and selection data, WRITE to Carrier Corporation, Syracuse, New York.

Carrier

AIR CONDITIONING
REFRIGERATION
INDUSTRIAL HEATING

0
1
2
3
4
0
1000
2000
3000
SPRING SIZE, No 8
BLAW-KNOX CO
POWER PIPING DIVISION
BLAW-KNOX
PIPE HANGERS
SUPPORTS
VIBRATION ELIMINATORS

complete hanger assemblies save your engineering time

For complete information, write for your copy of Bulletin No. 54.

You can save many hours of engineering time and speed up your specifications by using Blaw-Knox overhead roller assemblies, rigid hanger assemblies, functional spring hangers with the patented *internal swivel action*, and vibration eliminators.

Each is a complete unit designed for a specific purpose. Constructed to comply with the "code for pressure piping" requirements. Available in types and sizes to meet varying conditions.

And each is ready to install. So you also eliminate expensive cutting, threading and assembling in the field.

Any time you'd like some help, our experienced engineers are available to both design and make recommendations for your hanger requirements.

BLAW-KNOX COMPANY Power Piping and Sprinkler Div., Pittsburgh 33, Pa.

BLAW-KNOX

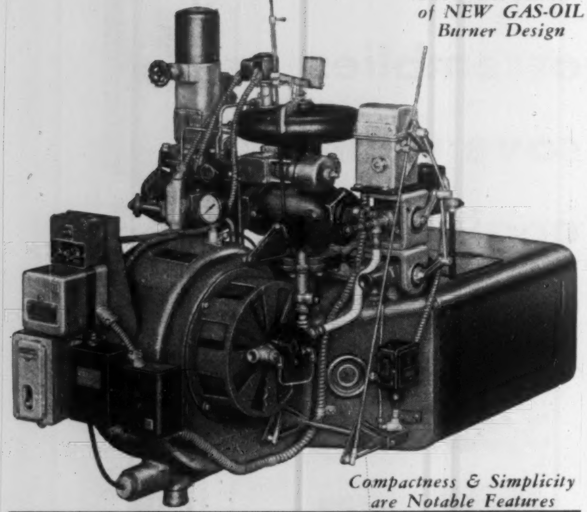
PIPE HANGERS

Complete line of functional spring hangers • rigid hanger assemblies • overhead roller assemblies • supports • vibration eliminators . . . plus complete prefabricated power piping systems *a distinguished* AUTOMATIC MECHANICAL DRAFT "PACKAGED"

DUAL FUEL BURNER

BUILT ON THE *"Entrained Combustion"* PRINCIPLE

The "Forerunner" of NEW GAS-OIL Burner Design

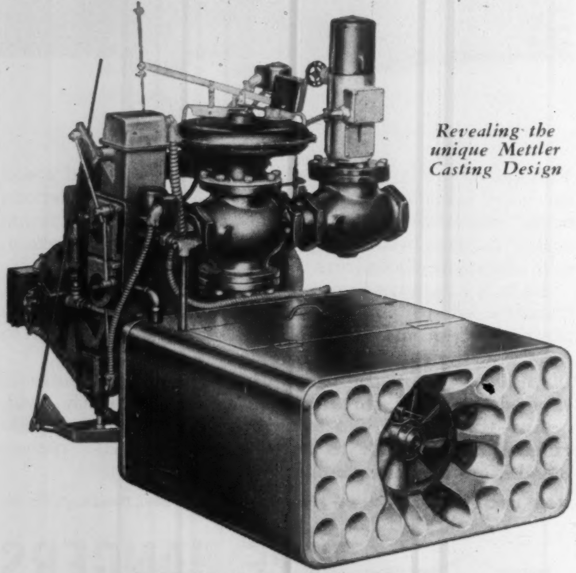


Compactness & Simplicity are Notable Features

Model MGO-5D4 - Gas or Oil - 250 H.P.

Meet the latest, not a combination of "Old Stuff," but an entirely new Gas or Oil Burner designed to fill the trend and need of the Gas Industry. Fully automatic Mechanical Draft burner employing the ENTRAINED COMBUSTION PRINCIPLE operates equally efficiently with any gas or No. 2 to No. 5 Fuel Oil. A "flip of the switch" or automatic remote control changes from Gas to Oil or in reverse. Nothing else like it on the market. Another example of Mettler Leadership designed to fill the trend and need of the Gas Industry for peak-load emergencies. Sizes 25 to 500 h.p.

Revealing the unique Mettler Casting Design



WORTHY OF YOUR SPONSORSHIP • PROMPT SHIPMENTS ASSURED • WRITE FOR DETAILS

The METTLER CO. INC.

4366 WORTH ST. LOS ANGELES 63, CALIF.

RECENT TRADE LITERATURE

Continued

Unit Heaters

Bulletin 7517 covers the latest design of "Venturafin" unit heaters for steam or hot water applications. The information covers features of design, general engineering data, capacity tables and piping diagrams.

Manufacturer—American Blower Corp., Detroit 32, Mich.

Warm Air Space Heaters

A brochure of engineering case studies describes nine ways in which warm air space heaters were used to heat a variety of diversified manufacturing plants. Each bulletin in the brochure describes an individual plant's requirements and lists the benefits derived by installing oil or gas fired warm air space heaters.

Manufacturer—Dravo Corp., Dravo Bldg., Pittsburgh 22.

Water Treatment

The importance of eliminating high product rejection and damage to machinery from impure water is outlined in the folder, *Primary Water Treatment.* According to information in the booklet, water may contain many kinds of potential trouble makers which can operate in boilers, condensate return lines, condensers, heat exchanger and process equipment. Various types of treatment are described.

Published by—Hall Laboratories, Inc., Hagan Bldg., Pittsburgh 30.

NEW REPORTS ISSUED . . .

PROCEEDINGS of the THIRD ANNUAL WATER SYMPOSIUM on WATER POLLUTION—published by the Engineering Experiment Station, Louisiana State University, Baton Rouge, La. Copies are priced at 50 cents each.

STUDIES OF THERMAL CONDUCTIVITY OF LIQUIDS, PART IV—a literature survey of ultrasonic velocities in liquids and solutions.

The publication is listed as Bulletin 46 and is available for $1.00 from the Engineering Experiment Station, Louisiana State University, Baton Rouge, La.

18th ANNUAL MEETING CONFERENCES—transactions of the technical conferences held at the 18th annual meeting of the Industrial Hygiene Foundation.

Copies of the transactions are priced at $3.00 and may be ordered from the Industrial Hygiene Foundation of America, Mellon Institute, 4400 Fifth Ave., Pittsburgh 13.

ANOTHER d-h "PLUS!"

"HOT DIP" Galvanizing

AFTER FABRICATION ON ALL

PERMA-FAN

EVAPORATIVE CONDENSERS

EDISON
EDISON

A NEW D-H JOB:
Edison Company
business offices,
Ontario, California
PF-304

Installation by Key Refrigeration, Los Angeles.

IT'S SERVICE-FREE PERFORMANCE with Perma-Fans—ever since D-H pioneered the blow-thru principle of operation, back in 1937!

NOW, new and proven advances give you an expanded Perma-Fan line:

- In tonnage ratings from 5 to 105
- For indoor or outdoor installation
- Choice of refrigerants: Freon, Ammonia
- "Hot Dip" galvanizing on ALL surfaces

Particulars? Request Catalog PF C-3.30.

d-h SINCE 1910

drayer-hanson
INCORPORATED
3301 MEDFORD STREET, LOS ANGELES 63, CALIFORNIA
(A Subsidiary of United States Radiator Corporation)

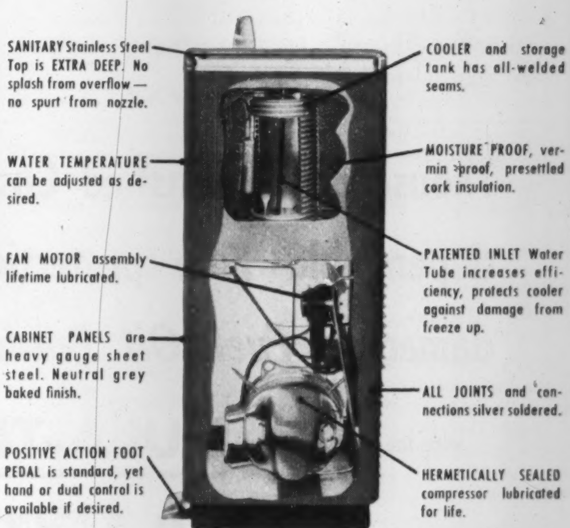
We invite you to...

LOOK INSIDE

it's the sturdy . . .

TEMPRITE

Drinking Water Cooler



SANITARY Stainless Steel Top is EXTRA DEEP. No splash from overflow — no spurt from nozzle.

WATER TEMPERATURE can be adjusted as desired.

FAN MOTOR assembly lifetime lubricated.

CABINET PANELS are heavy gauge sheet steel. Neutral grey baked finish.

POSITIVE ACTION FOOT PEDAL is standard, yet hand or dual control is available if desired.

COOLER and storage tank has all-welded seams.

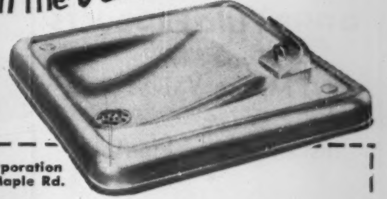
MOISTURE PROOF, vermin proof, presettled cork insulation.

PATENTED INLET Water Tube increases efficiency, protects cooler against damage from freeze up.

ALL JOINTS and connections silver soldered.

HERMETICALLY SEALED compressor lubricated for life.

The Cooler with the DEEP Stainless Top!



Stainless Steel won't crack or chip.

Easy to clean and keep clean!

Temprite Products Corporation
P. O. Box 72-L, East Maple Rd.
Birmingham, Michigan

Send me distributor franchise information, I am interested in handling Temprite Water Coolers.

Name______________________________

Address____________________________

City____________________ State__________

WHO'S WHAT . . .

▶ *DAVID E. FEINBERG,* formerly vice president, has been elected president of *UNITED STATES AIR CONDITIONING CORP.*

▶ *FRED W. EMHARDT* has been appointed chief engineer of *STRUTHERS WELLS CORP., WARREN DIV.* With the company since 1936, he was most recently assistant manager of the Process Equipment Dept.

▶ *WINSMITH, INC.* has announced the promotion of *JOHN E. SIXT* to sales manager and *RICHARD E. FELDMAN* to assistant general manager.

▶ *MILTON S. ANGIER* has been appointed product manager of heat pumps for the Air Conditioning Div. of the *WESTINGHOUSE ELECTRIC CORP.*

▶ *JOHN CRIM* has been promoted to sales engineer of *ROBERTS-GORDON APPLIANCE CORP.* He had been assistant works manager.

▶ The board of directors of *BITUMINOUS COAL RESEARCH, INC.* has announced the appointment of *JAMES R. GARVEY* to the position of assistant director of research, in charge of the Columbus branch office and laboratory. He will also serve as general manager of *BCR PRODUCTS, INC.* Mr. Garvey succeeds *ELMER R. KAISER,* who is now director of research for the *AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.*

▶ *GEORGE D. CASGRAIN, JR.* has been appointed assistant secretary and assistant treasurer of the *UNION ASBESTOS & RUBBER CO.* He succeeds Paul W. Austin, former secretary and treasurer, who has resigned.

▶ *FRANKLIN GREENE* has been named public relations director of the *INSTITUTE of BOILER and RADIATOR MANUFACTURERS.* The public relations department is being organized as part of the institute's expansion program.

▶ *LAWRENCE W. BERGHEIMER* of the *PATTERSON-KELLEY CO.* has been appointed general superintendent in charge of all plant operation. Prior to his promotion he was plant engineer.

Thousands of Satisfied Customers have dependable *Yula* protection against damaging *Fuel Oil Pre-heater LEAKS*

with the New Improved **YULA-TROL** Fuel Oil Detector

and **YULA "YT"** "U" Tube Fuel Oil Heater

YULA-TROL-PRODUCTS
PAT. NO. 2610267

Approved by the New York City Board of Standards and Appeals. No. 367-50 S.A.

Patent No. 2,610,267

A.S.M.E. CONSTRUCTION

The *Yula-trol* is connected with a probe in the shell of the Fuel Oil Pre-heater. If water is displaced from contact with the probe by oil or air, the Yula-trol instantly shuts off heating unit. Sounds alarm.

•

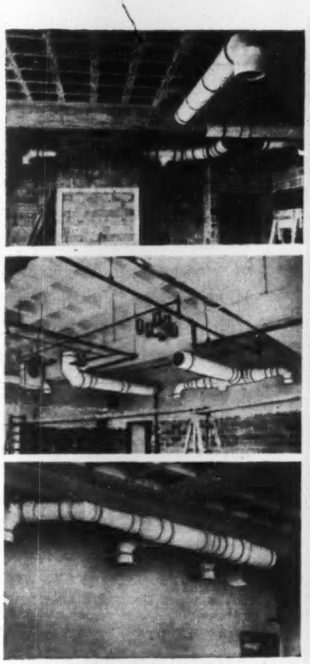
The new, improved *Yula* "YT" "U" Tube Heater precludes possibilities of Air Pockets. It is designed to pre-heat No. 6 (Bunker C) fuel oil efficiently and economically by use of hot water as the heating medium.

OTHER *Yula* PRODUCTS
Type "M"
Mixing Valves
•
Instantaneous Heaters
•
Converters
•
Dry Expansion
Freon Coolers

For Complete Information write . . . . . DEPT. HP

YULA WATER HEATERS, INC.
166 WEST 225th STREET, NEW YORK 63, NEW YORK
MEMBER FUEL OIL AND WATER HEATER MANUFACTURERS ASSOCIATION

Specify the Vent Pipe that's built to last . . .



Transite® Industrial Vent Pipe

Stands up under corrosive conditions

Transite Industrial Vent Pipe has been successfully used for many years, in industry after industry, to overcome the corroding action of highly aggressive fumes and vapors. In the photographs shown above, this durable pipe is being installed for venting corrosive fumes so frequently encountered in chemical laboratory installations.

This vent pipe will not only give long trouble-free service, but give it with very little maintenance because:

1. **It's made of asbestos and cement—cannot rust or rot.**
2. **It needs no painting or other preservative finish—ever—whether used indoors or out.**
3. **It is resistant to many corrosive fumes, mists and gases.**

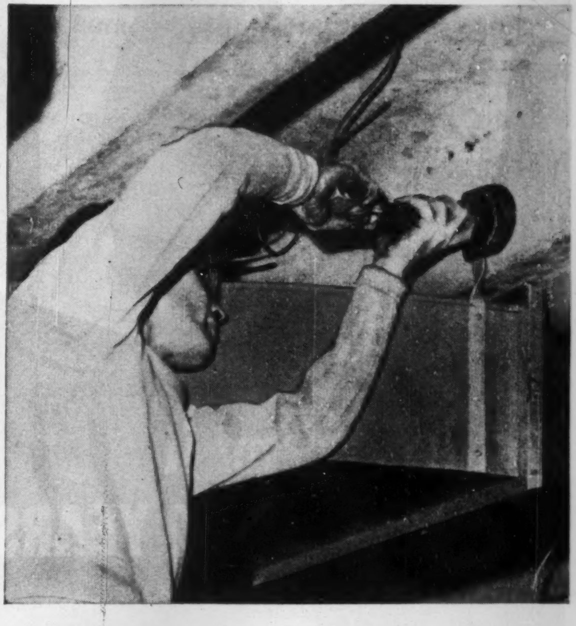
Transite Industrial Vent Pipe—as vents, ducts, stacks for indoor or outdoor use, for laboratories and industrial plants—is adaptable to a wide range of requirements. It is quickly and economically installed. It is light, strong and durable . . . is easy to assemble . . . can be worked with ordinary tools. Write for your free copy of DS-336 "Transite Industrial Vent Pipe for Ducts, Vents and Stacks." Address Johns-Manville, Box 60, N. Y. 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville

TRANSITE INDUSTRIAL VENT PIPE

AN ASBESTOS-CEMENT PRODUCT



Ramset FASTENING SYSTEM SAVES $11,000

for Fastening Air Ducts in Texas' Largest Store

More than two miles of air conditioning ducts were installed with RAMSET SYSTEM in the new addition to Joske's Department Store at San Antonio, Texas, the "largest store in the largest state."

By using RAMSET Jobmaster, anchoring studs were set at the rate of better than 1 per minute, instead of an estimated 15 minutes each by old-fashioned, conventional methods. Substantial cost savings were thus gained, as well as a far faster, completely secure installation. Similar results were obtained for hanging 13 miles of sprinkler piping and anchoring 43 miles of electric conduit.

Ask your dealer or write us for details on how you can make more profit from every job by using RAMSET SYSTEM.

UL
Ramset Fasteners

Ramset Fasteners, INC.

Ramset Division, Olin Industries, Inc.
12109 BEREA ROAD • CLEVELAND 11, OHIO

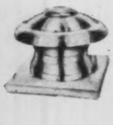
FIRST IN POWDER ACTUATED FASTENING AN Olin PRODUCT

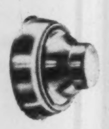
Look for this name plate. It is your guarantee of protection on a Jenn-Air Exhauster motor
LUBRICATION... THIS MOTOR IS LUBRICATED FOR 10 YEARS OF NORMAL SERVICE
Set it...forget it for 10 YEARS

Now Jenn-Air Low Contour Exhauster Motors are Lubricated for 10 Years of Service

Once a Jenn-Air Exhauster is set in a wall or on a roof, you can forget maintenance, because the motor is lubricated for 10 years of normal service. Since the bearing is the heart of any motor, you know this vital part is adequately protected in a Jenn-Air Exhauster. This is another feature by Jenn-Air, which has been FIRST with spun aluminum, rust-proof construction, no painting necessary; FIRST with simplicity of installation and ease of cleaning. Exclusive dual low-contour design means beauty that blends with today's modern architecture. It means fitting ventilation needs to the building which adds up to savings in labor and maintenance. Consult Jenn-Air Ventilating Specialists on ventilating problems.

Low contour Roof Exhausters blend with architectural design of building





Wall Exhausters —architecturally sculptured button design-spots ventilation control

JENN-AIR PRODUCTS COMPANY, INC.
Architects & Builders Building
Indianapolis 4, Indiana

Jenn-Air Products Company, Inc.
Architects & Builders Building, Indianapolis 4, Indiana
Please send me your free catalog 53B.

Name____________________
Title__________ Company__________
Address____________________
City__________ State__________ HPAC

WHO'S WHAT

Continued

▶ *E. K. STEVENS*, vice president and treasurer of the *INTERNATIONAL EXPOSITION CO.*, has been elected president, succeeding the late Charles F. Roth. He also becomes manager of the National Exposition of Power and Mechanical Engineering, International Heating and Ventilating Exposition, and the Exposition of Chemical Industries. Mr. Stevens has been associate manager for the past 20 years.

▶ New sales engineer for the *COPELAND REFRIGERATION CORP.* is *JAMES E. BARKER.*

▶ The board of directors of *RHEEM MFG. CO.* has elected *LIEUT. GEN. ALBERT C. WEDEMEYER* (USA, Ret.) a vice president and director. General Wedemeyer will make his headquarters at the company's New York executive offices at 477 Madison Ave. He has held a similar post since 1951 with Avco Mfg. Co.

▶ *GENE WEDEREIT* has been re-elected chairman of the board of trustees of the *NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION's RESEARCH INSTITUTE.* He is director of advertising of the Girdler Co. and Tube Turns, divisions of the National Cylinder Gas Co.

▶ *G. O. KUHEN*, former assistant air conditioning service manager at *SERVEL, INC.*, has been promoted to the newly created position of technical assistant to the manager of the air conditioning division.

▶ New assistant sales manager of *BASTIAN-MORELY CO., INC.* is *F. G. JOHNSON.*

▶ *EARL H. NORLING* has been appointed manager of sales training and marketing personnel for the Marketing Dept. of the *GENERAL ELECTRIC CO.'s* Air Conditioning Div. He will work with field representatives and distributors to develop selling programs.

▶ *L. J. SORENSON*, who has held top positions in the *DEEPFREEZE APPLIANCE DIV.* of *MOTOR PRODUCTS CORP.* for the past several years, has been elected president of the parent company.

▶ Returning to Milwaukee from Houston, where he had most recently been manager of the LPG Div. of *A. O. SMITH CORP.*, *GEORGE E. KEMPER* has been appointed general manager of the corporation's Welding Products Div.

Pump Performance

BRIEFS

from the Yeomans Guard

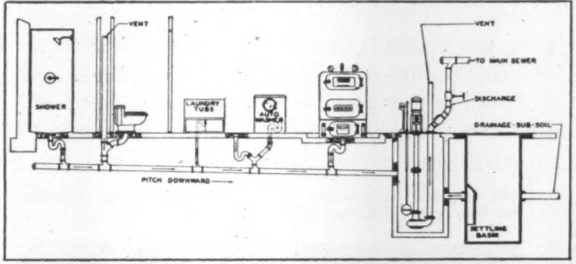
SEE

this amazing pump

in your office!

35 mm. full-color sound slide film gives an interesting, worth-while story of the SHONE (R) Pneumatic Ejector, the heart of the sewage collecting system. Takes only 15 minutes — shows exactly how the Shone works — explains the importance of lift pumps in the sanitary sewage collecting system — defines the place of pneumatic ejectors and centrifugal pumps — gives in a few brief moments the facts you want to have.

See this film at your early convenience. You may want to have your associates or your professional group see it also. Phone your local Yeomans representative listed in the Yellow Pages of your *telelphone book under "Pumps"* or write us direct.

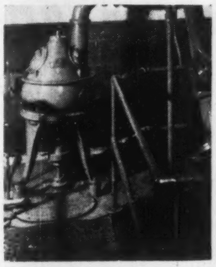


How to Avoid Pumping Problems with Sub-Surface Drainage

This typical installation diagram shows how a vast amount of trouble can be avoided where a sump pump handles sub-surface drainage. The secret is the settling basin to settle out sand and grit. Without such a basin the sand and grit flow directly into a pump that was never intended to handle them — and serious damage to the pump bearing is almost a certainty.

A score of other tips on wet pit pumps — uses, selection, installation and maintenance — are contained in Yeomans Bulletin 3-8001. Check the box below and mail this ad to Yeomans for your free copy.

43 Year Old
Vertical Submerged Centrifugal Pump Working Daily at Monroe Bldg., Chicago



Chicago's Monroe Building experience is just one more example of the perfected performance built into all Yeomans Pumps. An outstanding feature of today's Yeomans Vertical Wet Pit Centrifugal Pumps is the Lubri-Vac (R) Lubricating System which consists of impeller with special repelling vanes and lubrication lines to bearing and lubricant. This design has been proved in laboratory tests and field installations to reduce bearing failures and servicing between 90 and 95 percent. It eliminates scoring of radial bearing by providing positive lubrication. In addition the vanes serve as scavengers for material that might lodge between impeller and pump casing. ® Registered Trademark

☐ **Please send Bulletin 3-8001.**

See Pre-Filed Catalogs for complete line of Yeomans Pumps and Equipment or call your local Yeomans representative.

YEOMANS BROTHERS COMPANY
2000-5 North Ruby Street, Melrose Park, Ill.
(Suburb of Chicago)

In 99 Park Avenue, the last word in most up-to-date building methods and materials, as in other of the nation's newest, most modern office buildings and industrial plants,

Fairbanks Valves fill the specs.

FAIRBANKS VALVES

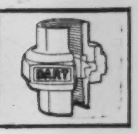
Proven to give longer service under difficult operating conditions, proven lower in maintenance costs!

99 Park Avenue

notable addition to the Manhattan skyline. New York City's first aluminum-faced skyscraper. A great construction achievement by the Tishman Realty & Construction Co., Inc., 445 Park Avenue, New York 22, New York. Architect: Emory Roth & Sons. Consulting Engineer: W. R. Cosentini & Associates, New York. Heating, Ventilating & Air Conditioning: Raisler Corporation, New York. Plumbing: John Weil Plumbing Corp., New York. Sprinkler: Raisler Corporation.

Men who know valves best specify and order Fairbanks Valves. For these men have learned that Fairbanks Valves insure trouble-free control of water, steam, gas, or oil. They know that Fairbanks Valves are engineered, designed, and manufactured to the highest standard of the industry. And they know that Fairbanks Valves fill their every requirement, for Fairbanks makes the complete line of bronze and iron body valves. YOURS Without obligation, send for Fairbanks Valves Brochure, describes, with cutaways, complete line of Fairbanks Valves.

THE FAIRBANKS COMPANY
393 Lafayette Street, New York 3, New York
Branches: New York 3, Boston 10, Pittsburgh 22, Rome, Georgia
Valves • DART & Pic Unions • Trucks • Casters • Wheels



▶ *DON F. BENNETT* has been appointed vice president in charge of sales of *WARREN WEBSTER & CO. NEWTON W. MacNICHOL* has become manager of radiation and unit heater sales, succeeding Mr. Bennett. *JOHN J. CARROLL*, purchasing agent and a director, was appointed assistant treasurer.

▶ *C. C. FULLER* is the new vice president-treasurer of the *AMERICAN BLOWER CORP.* and *ARTHUR V. LAFAVE* is assistant treasurer and assistant secretary.

▶ New officers elected at the annual meeting of the *AIR CONDITIONING BLOWER MANUFACTURERS ASSOCIATION* are *WALTER A. CURTIS* of the Peerless Electric Co., president, and *HOMER F. BRUNDAGE* of the Brundage Co., vice president. *F. W. BRUNDAGE* will serve as secretary-treasurer.

▶ *HAROLD N. JONES* has been named general sales manager of the *UTICA RADIATOR CORP.* New director of sales promotion is *FRANCIS R. BRENNAN.*

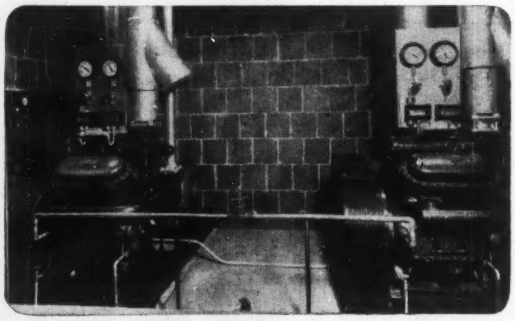
▶ *EDWARD K. KALLA* has been named sales manager of *ANESITE CO.*, manufacturer of plastic pipe.

▶ *GEORGE BEESE* has joined *UNIVERSAL CONTROLS CORP.* as plant manager in charge of all production and purchasing. He had been with C. A. Dunham Co.

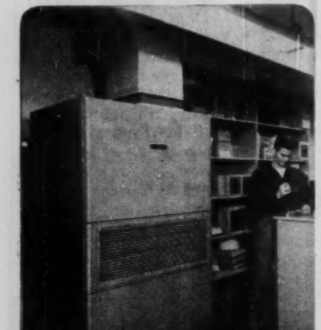
▶ *HOWARD J. EVANS*, former chief engineer of the Pittsburgh Equitable Meter Div. of *ROCKWELL MFG. CO.*, has been promoted to chief engineer and manager of the Central Gas Products Research and Development Dept. *H. A. ALTORFER*, former chief engineer of Rockwell's Nordstrom Valve Div. has been named chief engineer and manager of the Central Valve Research and Development Dept.

▶ Four new vice presidents have been elected by the board of directors of the *BELL & GOSSETT CO.* Those named were *W. A. BOONE, H. A. LOCKHART, R. A. MARQUARDT*, and *C. R. SMITH.*

▶ At the annual stockholders' meeting of the *REDMOND CO., INC., CHARLES W. FROST* was elected chairman of the board of directors and *JAMES W. TWEEDY* was named president and a director.



Frick "ECLIPSE" compressors, like these installed in the Constitution Bldg., have 2, 3, 4, 6, or 9 cylinders.

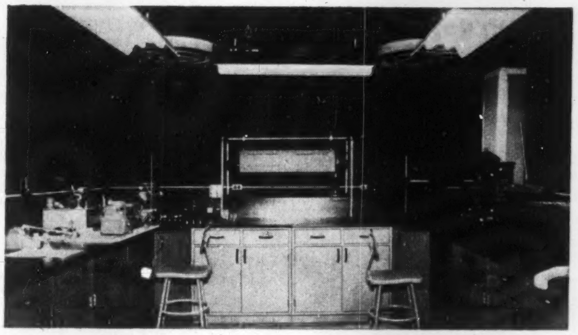


This 5-hp. Frick unit air conditioner is equipped with duct work to condition the retail store of the Georgia Power Co.

Constitution Building, Atlanta, Installs FRICK Air Conditioning Throughout

This modern building, occupied by the Georgia Power Co., now enjoys year 'round air conditioning.
The main cooling load is carried on a "central station" basis by four Frick "ECLIPSE" compressors: two of these are installed in a penthouse, and the others on the fourth floor.
In addition, Frick unit air conditioners of 5 and 7½ hp. serve the retail store on the street level, and the executive suite on the fourth floor. Operation of both types of systems is very satisfactory.
Whether you are an owner, architect, builder, heating contractor, or refrigeration distributor, we have air conditioning equipment and services of interest to you. Write for literature, estimates, or dealer contracts today: certain good territories still open.

DEPENDABLE REFRIGERATION SINCE 1882
FRICK Co.
WAYNESBORO, PENNA. U.S.A.



You Can Have DRY Air with EXACT Moisture Control

for your comfort, for your process, for testing machines or materials at any time of the year

Niagara Air Conditioning provides you with any temperature and relative humidity you need, held constant or varied at will. Using "Hygrol" absorbent, you save the refrigeration commonly used to condense moisture and make reheat unnecessary in most cases. It gives large capacity with compact, easily-maintained equipment.

This Niagara Air Conditioning Method dries air directly and measurably, using a moisture-absorbing liquid spray. Humidity control is a separate function from heating or cooling.

This gives you precise control over your air conditions with thermostats alone; no moisture-sensitive devices are needed. You have simpler, more trustworthy, less expensive control instrumentation. Niagara precise-control air conditioning installations have the best record for reliability.

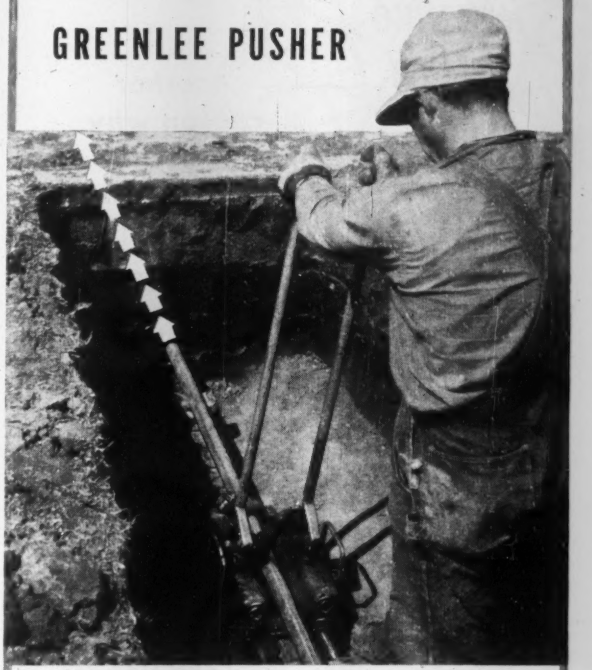
Write for information on the application to your problem. Ask for descriptive Bulletins #112 and #121. Address Dept. HP

NIAGARA BLOWER COMPANY

405 Lexington Ave. New York 17, N. Y.

District Engineers in Principal Cities of U. S. and Canada

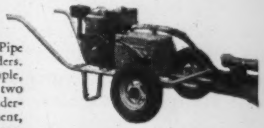
CUT COSTS ON UNDERGROUND PIPING INSTALLATIONS WITH GREENLEE PUSHER



Save hours of time, cut job costs with this quick, easy way of installing underground pipe. With a Greenlee Hydraulic Pipe Pusher, *one man* pushes pipe *under* streets, walks, tracks, lawns, floors, and other obstacles. No costly tearing up of paving . . . eliminates extensive ditching, as just a short trench accommodates the Pusher. No tedious tunneling, backfilling, tamping, repaving. Compact, portable, powerful. Often pays for itself on first few jobs. Thousands in use for big savings of time and labor. Two models: one for ¾ to 4″ pipe, one for larger pipe, concrete sewer pipe, drainage ducts. Write for facts today.

POWER PUMP

For all models of GREENLEE Pipe Pushers and Hydraulic Pipe Benders. Makes the toughest pushing jobs simple, fast. Average pushing performance: two feet per minute. Rubber-wheeled undercarriage, available as extra equipment, provides convenient, easy way to transport and move about on job location.



TOOLS FOR CRAFTSMEN

GREENLEE

Greenlee timesaving tools for plumbing and heating work: Hydraulic Pipe Pushers • Hydraulic Pipe Benders • Tubing Benders • Pipe Bits Auger Bits • Spiral Screw Drivers • Chisels • And many more
Greenlee Tool Co., 2349 Twelfth Street, Rockford, Illinois

SERVICED BY THE MEN WHO SELL IT

Another reason why You can depend on

TAPECOAT®

the Coal Tar Protection in Handy Tape Form

The service behind TAPECOAT is as distinctive as this coal tar coating, itself.

To make this service as dependable as the product, the sales engineer who sells the job also services it. This means that you can count on everything he tells you because he is responsible for the job *personally*.

The fact is, TAPECOAT gives you more lasting protection for your money because it is a quality coal tar product, and coal tar is nature's own defense against corrosion.

Specify TAPECOAT for pipe, pipe joints, tanks, and other vulnerable steel surfaces above or below ground. Its performance record since 1941 merits your complete confidence.

TAPECOAT comes in rolls of 2", 3", 4", 6", 18" and 24" widths. It's easy to apply as our sales engineers will demonstrate.

Write for brochure and prices today.

The TAPECOAT Company

Originators of Coal Tar Tape Protection

1555 Lyons Street, Evanston, Illinois

WHO'S WHAT

Continued

▶ *JOHN T. SEAMAN* has been appointed division superintendent of power and fuel at the Gary works of *UNITED STATES STEEL CORP.* He succeeds *ARNOLD J. BEYER*, recently named chief engineer at the Gary works. *ROYAL J. SCOVILL, JR.* was named to succeed Mr. Seaman.

▶ *WALTER M. GIBBS, JR.* is the new sheet product manager for *KAISER ALUMINUM & CHEMICAL SALES, INC.* He will be headquartered at the organization's Chicago general sales offices.

▶ *COL. H. F. SYKES, JR.* has assumed command of the main research center of the Corps of Engineers, the Engineer Research and Development Laboratories at Ft. Belvoir, Va.

▶ *R. G. BECKER*, formerly assistant sales manager of the Clark Div. of *McGRAW ELECTRIC CO.*, has been appointed sales manager. He succeeds *R. V. PALMQUIST*, who is establishing a firm of manufacturers' representatives in Des Moines.

▶ *M. ALLEN NEALY* has been named chief engineer of the Pump and Water System Div. of the *BARNES MFG. CO.* For 18 years he headed product engineering for the Peerless Pump Div. of the Food Machinery and Chemical Co.

▶ *ROBERT H. LODGE* is the sales manager for the newly created commercial and residential packaged air conditioning division of *MITCHELL MFG. CO.*

▶ *HARRY J. WINES* has been named general sales manager of *BURNHAM CORP.*, Boiler Div. Mr. Wines had been with the Bryant Heater Div. of Affiliated Gas Equipment, Inc.

▶ *WALTER W. SIMPSON* is vice president-operations of *STERLING AIR CONDITIONING CORP.* Mr. Simpson, who had been with Servel, will be in charge of engineering and production.

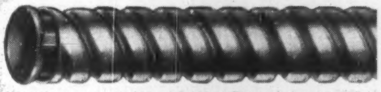
▶ *DUANE QUAMME* has been named assistant to *W. K. SMITH*, field sales manager of the *UNION ASBESTOS* and *RUBBER CO.'s* heating division.

▶ Two appointments for the Oil City works of *WORTHINGTON CORP.* are *E. W. THEILIG*, chief engineer of power pump engineering, and *R. K. GROBHOLZ*, manager of reciprocating pump sales.

ARMORED
BUSHED CABLE AND
THERMOSTAT CABLE
(UL APPROVED)

Easier Working!

CHESTER FLEXIBLE
STEEL CONDUIT



Longer Lasting!

OIL BURNER
IGNITION CABLE
FOR DAMP
LOCATIONS
UL APPROVED

Connect it with–

CHESTER®
plasticord-plasticote
WIRES & CABLES

STANDARD OIL BURNER
IGNITION CABLE

PLASTICOTE
THERMOSTAT CABLE

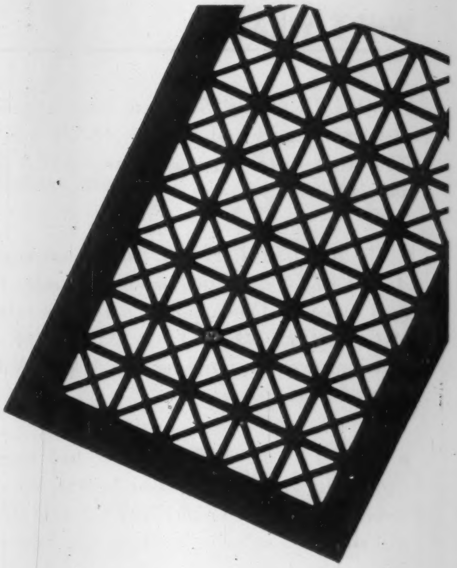
TW BUILDING WIRES

INSTRUMENT WIRES

Rugged Plasticord and Plasticote CHESTER coatings are extra smooth, extra pliable — easier to work with. They're longer lasting, too, because CHESTER ruggedized plastic coatings offer the maximum in resistance to oil, grease, water, dirt and grime. For easier wiring, better wiring — choose CHESTER. All constructions built to exceed service requirements.

"Chesty" says —
For dependable wiring — consult the Chester catalog. Write for your copy, today!

CHESTER CABLE CORP.
CHESTER, NEW YORK



for *Enhancing* **beauty**

Add a touch of beauty and utilitarian design to your decorative motif with Hendrick Perforated Metal Grilles. Your clients will go for that extra elegance they add to a room.

Hendrick Perforated Metal Grilles provide more-than-ample open area for free passage of air and are available in over one hundred attractive basic designs to choose from. And they're easy to install because they always lie flat — they won't bend or warp. For more complete details write Hendrick direct.

SEE OUR CATALOG IN SWEET'S

Hendrick
MANUFACTURING COMPANY

48 DUNDAFF ST., CARBONDALE, PA. • *Sales Offices in Principal Cities*
Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Architectural Grilles • Mitco Open Steel Flooring • Shur-Site Treads • Armorgrids

WHO'S WHAT

Continued

▶ *ROBERT O. BRIGGS* has been appointed central district manager and *JAMES ANNIS* has been named New York district manager for *LANCASTER PUMP and MFG. CO.*

▶ The *REPUBLIC STEEL CORP.* has appointed *SAM A. SECKLER* assistant manager of sales for the alloy steel division. This appointment follows the promotion of *CLYDE E. ROBERTS* to manager of sales for the division upon the retirement of *MARTIN H. SCHMID* from that position.

▶ *CHARLES R. SORBER, JR.* has been appointed Cincinnati district supervisor for the Metal Processing Dept. of the *PENNSYLVANIA SALT MFG. CO.* He will supervise sales in Indianapolis, Louisville, Columbus and St. Louis.

▶ *EVERETT L. DAWKINS* has been appointed sales representative of the Williams Div. of *EUREKA WILLIAMS CO.* Mr. Dawkins has had 14 years experience in the heating field.

▶ A new manufacturers' representative, *E. M. TARNOFF CO.*, has been established by *E. M. TARNOFF* to handle sales of industrial heating, ventilating and air conditioning equipment in metropolitan New York and Connecticut. He was formerly associated with the industrial heating division of the Prat-Daniel Corp.

▶ Several appointments have been announced by the *INTERNATIONAL NICKEL CO., INC. J. M. WELDON* has been transferred to the general sales department as assistant to the vice president. *C. J. BIANOWICZ* is manager of the Inco Nickel Alloys Dept. *D. W. MACHON* has been placed in charge of the newly established Cobalt Section of the Nickel Sales Dept.

▶ *JOSEPH T. RYERSON & SON, INC.* has announced the following management changes. *WEAVER E. FALBERG* is assistant general manager of sales of all the steel service plants, with headquarters in Chicago. *ROLAND W. BURT* is manager of the Chicago plant. Succeeding him as sales manager is *ALFRED J. OLSON*, who was formerly assistant sales manager.

▶ *GILBERT D. LORTZ* has been appointed sales manager of various insulation products for the *PHILIP CAREY MFG. CO.*

BOILER
REMOVABLE COVER PLATES FOR EASY INSPECTION
HIGH LEVEL STOP SWITCH
COMPLETELY DUST-TIGHT HOPPER COVER
CAST IRON TROUGH FOR LONG LIFE
HOPPER
EXPOSED PORTION FOR COAL PICK UP IN BIN OR PILE
Flotubes
CANTON STOKERS

CANTON'S EXCLUSIVE NEW BINFED-RAMFEED STOKER

Conveys coal direct from coal storage to furnace without labor. Can be installed from front, side or rear of boiler. The complete Conveyor-Stoker is available as a package unit only from Canton Stoker Corp.

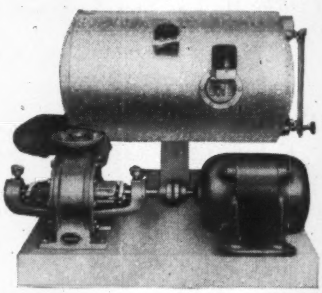
WRITE FOR THIS BROCHURE

This type of installation pays for itself usually within one year through savings in labor and increased efficiency. Completely automatic and dust-free, it allows use of Canton's rugged Vulcan or LoSet Ramfeed Stokers, with the steady, dependable Flo-Tube Spiral Conveyor keeping the hopper filled. Flow of coal is pro-rated according to steam demand. Write for complete information on this time and money-saving combination.

CANTON STOKER CORPORATION
SPECIALISTS IN AUTOMATIC COAL FIRING, HANDLING AND CONTROL EQUIPMENT

2400 Andrew Place S. W.
CANTON, OHIO

Entrust ALL of Your CONDENSATE RETURN JOBS to AURORA with complete confidence



These Horizontal

APCO

CONDENSATE RETURN UNITS

•

Simplex and Duplex

•

RATED
Sq. Ft. Equivalent
Direct Radiation
2,000 to 100,000

insure a high standard of service

Thousands of these units — simplex and duplex are in the service of practically every industry, winning engineer favor through excellent performance. They are designed for the automatic return to low and high pressure boilers of the hot water condensation from radiators, coils etc. Horizontal units are used where the returns are above the boiler from floor level.

★

APCO Handles Hot Water Perfectly — Will Not Vapor Bind or Lock.

★

Free Running Clearance Allows for Expansion Due to Heat.

★

SIMPLE, EFFICIENT, TROUBLE-FREE, LASTING

★

Replaceable Pump Covers an Economy

ALSO *we offer--*

AURORA Vertical Simplex Condensate Return Units — For under floor level return — 2,000 to 100,000 sq. ft. E. D. R. (Available in Duplex).

• • •

Vertical APCO-MATIC Simplex Condensate Return Units — Close to Floor Return — 800 to 10,000 sq. ft. E. D. R. (Available in Duplex).

• • •

APCO Packaged Square Tank Condensate Return Units. Handles to 15,000 sq. ft. E. D. R. against pressures up to 40 pounds. (Available in Duplex).

Rely upon Aurora Know-How and Aurora's exclusive attention to the manufacture of quality pumps for the VALUE you seek and your customer appreciates.

Complete Information on Request

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA *Always* PUMPS

AURORA PUMP COMPANY

DIVISION OF THE NEW YORK AIR BRAKE COMPANY

80 Loucks Street
Aurora, Illinois

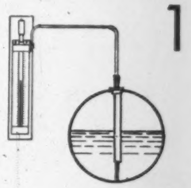
PETROMETER

4 steps to Better Measurement of Tank Contents

The PETROMETER

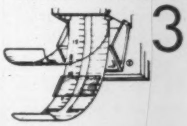
Tank Gauge offers you the convenience of Remote Reading plus these four extra features:

SIMPLE, TROUBLE-FREE DESIGN • • • No complicated and troublesome pulleys, springs, or other mechanical or electrical gadgets —the Petrometer gauge operates on the principle of static pressure—a principle that is as unfailing as the law of gravity. Its operation is similar to that of the familiar U-tube. Simple, rugged and dependable.

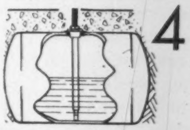


CONSTANT ACCURACY • • • The large vertical scale on the Petrometer gives you constant, accurate readings. The red liquid column is clearly visible—moves up and down as contents vary, just like the liquid level in your tank.

INTERCHANGEABLE SCALES • • • The scale on the Petrometer is readily removed or adjusted to correct for tank pitch or when changing liquids. No tools are needed.



EASY INSTALLATION • • • Gauges can be installed on tanks above or below the ground and up to ¼ mile away. The tank assembly for the gauge can be installed even when the tank contains liquid. It can also be fitted in the tank separately to complete the tank work and the gauge connected any time later. Just tighten one simple connection and installation is complete.

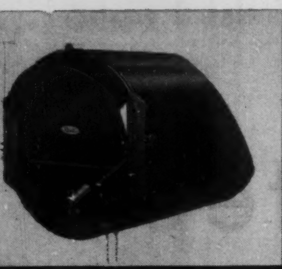


Send for Bulletin PH today.

7

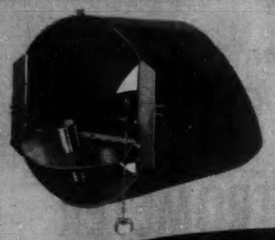
LIQUIDEPTH INDICATORS, INC.

43-22 TENTH ST., LONG ISLAND CITY 1, N. Y.



DOWN-DRAFT VIEW

Gate opens outward to relieve down drafts which might affect flame. An optional safety switch closes main gas valve in case of prolonged down draft, thus providing full protection.



UP-DRAFT VIEW

Gate opens inward to regulate updrafts in conventional, proven manner, checking any excess in draft.

field

"MG" Draft Controls

ENGINEERED SPECIFICALLY FOR

GAS

fired industrial and commercial plants

1. Double acting gate opens inward to regulate up-drafts and outward to relieve down-drafts.
2. Adding or taking off weights provides simple adjustment for up-draft conditions at time of installation.
3. Control will relieve internal or down-draft pressures of only a few thousandths of an inch.
4. Weights attached to gate itself are factory set to insure extreme sensitivity to down-draft conditions.
5. Corrosion resistant knife edge bearings resting on self-aligning bearing plates assure extreme sensitivity yet long life.
6. Side wings improve the regulation, making the control accurate at all gate positions.
7. Long collar keeps gate out of the path of flue gases — resulting in greatly increased life.

The Field "MG" has met the most rigid municipal requirements for commercial and industrial installations. It is being used with full approval of the nation's leading gas companies in the nation's largest cities. Fully safe, fully proven, it provides for gas-fired installations the same accurate, dependable performance, the fuel economy so long provided by Field Draft Controls for oil and coal fired furnaces. Write for complete information.

FIELD CONTROL DIVISION

of H. D. Conkey & Company — Mendota, Illinois

AFFILIATES: Conco Building Products, Inc. — Brick, Tile, Stone
Conco Materials Handling Division — Cranes, Hoists

WHO'S WHAT

Continued

▶ *CRANE CO.* announces the appointment of *MELVIN R. WALSH* as manager of the sales analysis department. He succeeds *ROBERT F. McDONALD*, who has been appointed staff assistant in the control division.

▶ *KENNETH H. FLORY* is the new purchasing agent of *FLEXONICS CORP.* He was previously assistant purchasing agent.

IN THE TERRITORIES . . .

▶ For the *BABCOCK & WILCOX CO.*, Boiler Div.—*RALPH K. BEHR* now is manager of the Boston district office. He replaces *H. K. DEAN*, who is retiring after 31 years with the company.

▶ For *UNION ASBESTOS and RUBBER CO.*, Heating and Cooling Div.—*AVERY M. WALSH and SONS*, Troy-East Greenbush Rd., East Greenbush, N.Y., has been appointed sales representative for "Unarco" heating and air conditioning equipment for Albany and the eastern New York area.

▶ For *BARNES MFG. CO.*—*RALPH C. MADER* is the new eastern district sales manager, covering New York and the New England states.

▶ For *BARBER-COLMAN CO.*—The Automatic Control and Uni-Flo Div. has opened a new branch office to serve the Birmingham, Ala. territory. Located at 2807 Central Ave., the office is under the management of *STANLEY SIMPSON*.

▶ For *TRION, INC.* — A new representative for southeastern Texas is *W. R. MOOK, JR.* His offices will be located at 3122 Pickwick Lane in Houston.

▶ For *RHEEM MFG. CO.* — *JOSEPH P. MAKENAS* has been named central region manager in the firm's Chicago and midwest area. Mr. Makenas succeeds *WILLIAM S. GOODFELLOW*, who is now eastern division manager and will assume responsibility for sales east of the Rockies.

▶ For *WARREN WEBSTER & CO.* — *CHARLES D. UPDEGROVE* has been appointed Trenton, N. J. representative with offices at 751 Pilgrim Ave.

▶ For *WESTINGHOUSE ELECTRIC CORP.* — A new franchise has been awarded to the *AIR-HEET CORP.* for heating equipment in the Chicago metropolitan area.

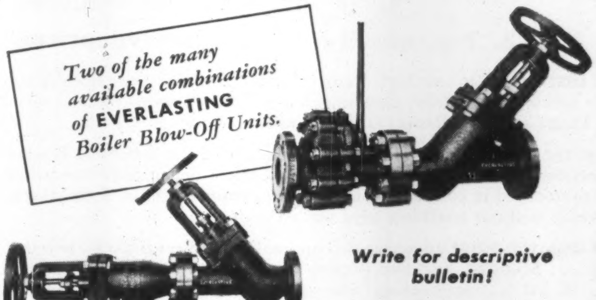
For Double BOILER BLOW-OFF *Safety*

SHUT
EVERLASTING
ANGLE
VALVE

These EVERLASTING Duplex Boiler Blow-Off Units are assuring double safety in plants all over the country.

In the unit illustrated above, the left-hand valve is the standard quick-operating EVERLASTING design which opens with a quarter-turn of the lever and closes with a drop-tight seal that actually improves with use. The right-hand valve is an EVERLASTING Angle Valve, stoutly built to withstand shocks and abrasion of blow-down solids.

Below are shown two additional EVERLASTING Duplex Units, each including the EVERLASTING "Y" Valve . . . simple and sturdy in design, with all parts interchangeable with those of the Angle Valve. All EVERLASTING boiler blow-off designs conform with ASME codes, and are available in a range of sizes for pressures up to 600 psig.



Two of the many available combinations of **EVERLASTING** *Boiler Blow-Off Units.*

Write for descriptive bulletin!

EVERLASTING VALVE CO., 61 Fisk Street, Jersey City 5, N. J.

Everlasting Valves

TRADE MARK "EVERLASTING" REG. U.S. PAT. OFF. EV372A

FOR EVERLASTING PROTECTION

ABOVE *everything else*

specify

PENN ROOF VENTILATORS

Penn Pullman stationary ventilators are highly efficient gravity roof ventilators with an especially large protected outlet area. They are capable of a high gravity exhaust. They prevent back drafts and they can be easily converted into powered fan ventilators by the insertion of a fan section between the ventilator head and mounting base when accelerated air movement is required.

You can depend on Penn Pullman ventilators to be completely weatherproof and structurally sound. Their wide use and reliability have made them a familiar part of many buildings throughout the world.

The Penn Ventilator man in your area has a complete line of both powered and gravity roof ventilators. You would do well to call on him for your next ventilation problem.

Complete Literature Available—write to Engineering Department

PENN VENTILATOR COMPANY

Representatives and Distributors in principal cities

PHILADELPHIA 40, PENNA.

FOR MORE THAN 25 YEARS THE BUILDERS' roof TOP LINE

WHO'S WHAT

Continued

▶ For *A. O. SMITH CORP.*—Three new sales engineers and their territories are *OWEN FORD*, Birmingham, Ala., covering Tennessee, Mississippi, Alabama, Georgia and Florida; *JAMES McKINNEY*, Los Angeles, covering the southern portion of California; and *GEORGE TWEED*, Chicago, covering northern Indiana and Gary.

▶ For *BAILEY METER CO.*—The Cincinnati district office has been moved to larger quarters at 2330 Victory Parkway. *R. M. CUNDIFF* is manager.

▶ For *DRAVO CORP.*—*GEORGE HEARD* is the new Pittsburgh district sales and service manager. *HARRY E. CASE* has joined the district office as a sales engineer.

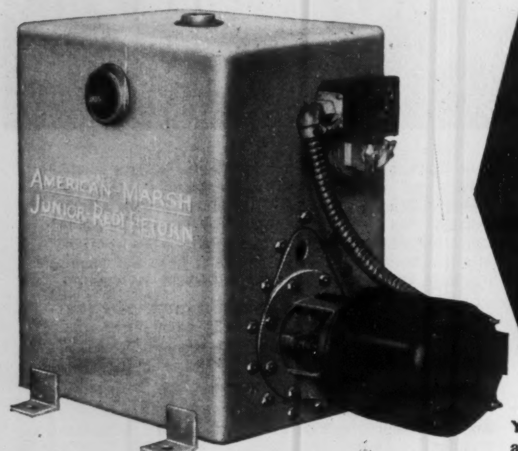
▶ For *GUSTIN-BACON MFG. CO.*—Two new district managers are *C. WESTON GOODE* for southeastern United States and *H. J. SMITH*, Kansas City, Mo. sales division. Mr. Goode is in charge of the newly opened district office at 2025 Peachtree Rd., Atlanta. Mr. Smith will direct sales in Colorado, Wyoming, Nebraska, Kansas, Oklahoma, Arkansas, Texas Panhandle, southern Illinois, western Tennessee and northern Mississippi.

▶ For *TYPHOON AIR CONDITIONING CO., INC.*—*MARTIN B. BELINE* and *ARDEN KRELL* have been appointed district sales manager. Mr. Beline will handle an eastern seaboard territory between New York and Virginia, making his headquarters in Philadelphia, while Mr. Krell will supervise a far west sales territory including California, Arizona and New Mexico.

▶ For *CRANE CO.*—*JOSEPH W. GREENE* has been named eastern district manager. With headquarters in New York City, he directs the activities of 18 branches in seven states. *DAVID J. MOLLOY*, who had been eastern district manager, now will manage the New York City branch. *DARELL R. NORDWALL*, new manager of the Los Angeles branch, succeeds *GEORGE C. PERRY*, who has taken a leave of absence.

▶ For *SERVEL, INC.*—Two newly appointed air conditioning distributors are the *SOUTHSIDE FUEL OIL CO.*, 3021 St. Augustine Rd., Jacksonville, Fla., and *LOUIS N. PICCIANO & SON*, 1204 Witherill St., Endicott, N.Y.

▶ For *KRITZER RADIANT COILS, INC.*—New representative in the metropolitan New York area is *SECO INDUSTRIES, INC.*, 29 Broadway. President of the firm is *CHARLES B. SECHTIG.*



A LINE YOU'LL LIKE...

these AMERICAN-MARSH Junior Redi-Return CONDENSATION UNITS offer you 3 DISTINCT ADVANTAGES

1. They save floor space.
2. No misalignment troubles.
3. Top quality at competitive prices.

SIZE 1—To 5,000 sq. ft. radiation at 20 lbs. discharge pressure—18,000 sq. ft. at 8 lbs. pressure.

SIZE 2—To 9,000 sq. ft. radiation at 30 lbs. discharge pressure—18,000 sq. ft. at 20 lbs. pressure.

YOU'LL LIKE INSTALLING Junior Redi-Return Units. They take little floor space and need no special foundation. Just bolt down, connect two pipes and electrical lead. That's all! Installation is speedy and profitable.

YOU'LL LIKE THE DESIGN that eliminates shaft alignment troubles. It also makes inspection simple and quick, and assures quiet, dependable operation of impeller submerged in condensate, even at temperatures to 210°F. Working parts removable without touching pipe connections.

YOU'LL LIKE QUALITY, PRICE advantages. Top-quality features include: Bronze-fitted pump . . . balanced, enclosed bronze impeller . . . lifetime lubrication . . . heavy, 16 gal. copper-bearing steel tank . . . drip-proof ball-bearing motor . . . heavy-duty float switch. Yet Junior Redi-Return Units are competitively priced — ideal for hotel, store, school, office and apartment heating systems.

Get performance and specification data —
WRITE FOR JR. REDI-RETURN BULLETIN 425.

Pumps and Pumps only Since 1873

AMERICAN-MARSH PUMPS

BATTLE CREEK MICHIGAN

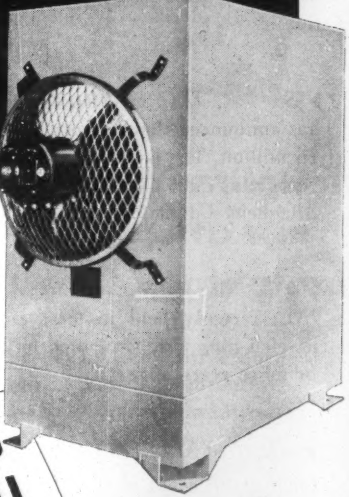
In Canada:
American-Marsh Pumps (Canada) Ltd., Stratford, Ont.

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, FIRE PROTECTION, ETC.

COOLING TOWER

by

KRAMER



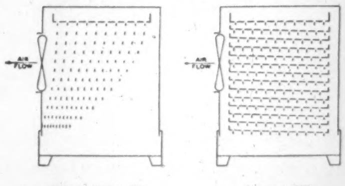
3 to 8 Ton

SCIENTIFIC NEW FILL

MORE CAPACITY
The redistributing decks keep the water uniformly suspended, providing maximum contact between air and water.

LONG LIFE
Casing and sump are heavy gauge steel, hot dipped galvanized after fabrication. Redistributing decks are metal and fireproof.

EASY INSTALLATION
Unit is shipped assembled but can be knocked down to eliminate rigging costs. One fitting required for drain and over-flow.



Conventional Fill — Kramer Fill

Write for Catalog R-225

KRAMER TRENTON CO.
Trenton 5, N.J.

Why So Many Heating Engineers SPECIFY Power-Flame BURNERS

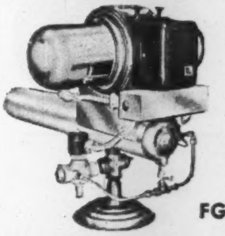
You'll find a Power-Flame Burner engineered to insure peak efficiency for EVERY Commercial, Industrial or Domestic Application.

BFG

Regardless of application, whether it be straight gas or combination gas-oil, heating engineers know that Power-Flame burners supply fuel-saving, easy-to-install, high-efficiency heating.

Every Power-Flame burner utilizes quiet, amply-sized blowers which provide balanced air mixture, eliminating the effects of natural draft conditions, and thus, providing metered air for complete combustion and highest heating plant efficiencies even in down-draft boilers or furnaces.

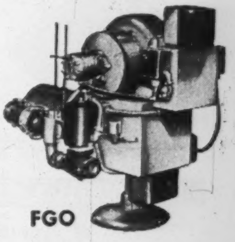
BFG Series (pictured above), 8 models in capacities from 450,000 BTU to 9,000,000 BTU input. With these features... factory wired—controls and valves mounted...wired sequencing panel provide purge period for utmost safety...positive control of air for combustion...dollar for dollar, the industry's best buy.



FG

FG Series 3 gun type units—Model FG 175, capacity 175,000 BTU, AGA listed; Model FG 330, capacity 330,000 BTU, AGA listed; model FG 500, 500,000 BTU. Ideal for replacement of oil burner... serves a wide range of hard-to-fire applications.

FGO Series—Combination Gas-Oil—6 models in capacity to 3,500,000 BTU input. Features include...automatic ignition for BOTH fuels...automatic air adjustment...electronic safeguard ...factory assembled and tested for both gas and oil. Automatic or manual changeover optional.



FGO

A Power-Flame dealership can be valuable. Write today for complete information.

Siemon Power-Flame BURNER Manufacturing Co.
1819 HOLMES DEPT. HP KANSAS CITY, MO.

FLEXIFLO

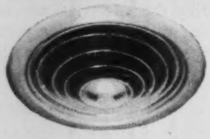
THE DIFFUSER WITH A BUILT-IN VOLUME CONTROL

FLEXIFLO adjustable air diffusers reduce installation costs by providing for rapid, easy adjustment of air volume and pattern after installation by simple knob adjustment.

Engineering is simplified since the FLEXIFLO's wide range of adjustability provides wide latitude in selecting the correct size diffuser.

FLEXIFLO diffusers assure uniform air distribution with built-in equalizing deflectors which are easily adjustable *after* installation. Rapid draftless mixture of supply and room air is assured.

FLEXIFLO diffusers for every cooling, ventilating and heating need are made in 12 standard sizes, up to a capacity of 12,000 CFM.

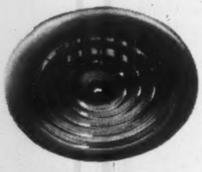


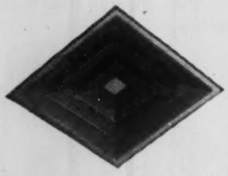
FOR COOLING

TYPE R—Air travels in a constant pattern parallel to the ceiling regardless of volume adjustment.

FOR COOLING & HEATING

TYPE V—Air diffusion pattern and volume are fully adjusable, after installation.



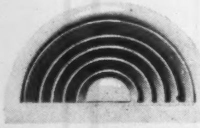


SQUARE

TYPE H—Fully adjustable square diffusers and fixed rectangular 2, 3, and 4 way diffusers.

FOR SIDEWALL & CEILING

TYPE S—With Type R or V blades to supply desired air pattern for ceiling or wall installation.



Write for technical data catalog on Flexiflo line

FLEXIFLO

Universal Diffuser Corp.

1350 Garrison Ave. • New York 59, N. Y.

WE HEAR THAT . . .

▶ *H. E. BOVAY, JR.*, consulting engineer, Houston, has established a northwest office in Spokane. From Spokane, the firm will provide engineering services in Washington, Oregon, Idaho, Montana, Wyoming, Utah, northern California, British Columbia and Alberta. *WILLIAM N. PAULEY* is in charge.

▶ Seventy-one graduates of the *INSTITUTE of GAS HEATING INDUSTRIES* engineering school in Los Angeles recently received certificates of completion. The nine-week curriculum devoted the first six weeks to heating problems and the last three to air conditioning.

▶ *SAUER, INC.*, mechanical contractor, Pittsburgh, has announced that its hospital contracts have reached $6 million. The latest is for the installation of heating, ventilating and air conditioning facilities in the new Allegheny County hospital.

▶ The Management Club of *DRAYER-HANSON, INC.* recently held its first annual dinner at which jeweled pins were presented to 25 employees with five or more years of service.

▶ *ARMCO STEEL CORP.'s* current $10 million expansion program at its Ashland, Ky., works is nearing completion. New facilities include a cold reversing mill, a continuous strip pickler and two "Zincgrip" lines designed to coat strip steel with zinc in a continuous operation.

▶ The *GENERAL ELECTRIC CO.'s* Commercial Products Dept. has been renamed the Commercial and Industrial Air Conditioning Dept. According to *G. K. IWASHITA*, department general manager, the change has been made because of the increased emphasis on selling air conditioning units to industrial buildings.

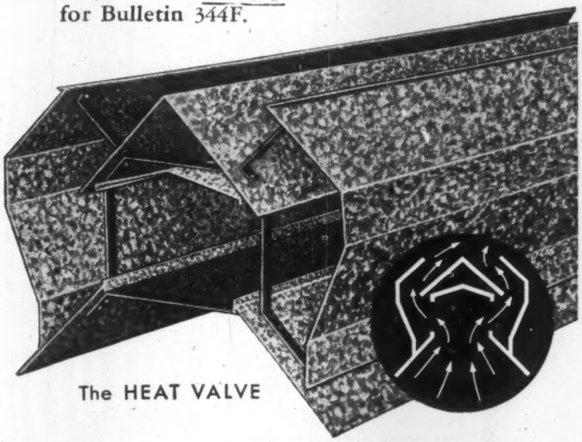
▶ *RESEARCH PRODUCTS CORP.* recently held its annual sales executive conference at Madison, Wis. Principal subject of the week-long meeting was the "E Z Kleen" washable air filter.

▶ The *WATERMAN-WATERBURY CO.* of Minneapolis is publishing a monthly *Minneapolis Degree Day Bulletin*. In the special "summer cooling" bulletin, published in July, the number of degree hours above 80 F are shown. A listing shows the normal degree hours above 80 F in July as compared with each year since 1910. The service is available on a subscription basis.

The AIRMOVER

For Low Cost *Natural* Ventilation it's good business to use these Swartwout Ventilators

Beat the cost of power and expensive duct work when *Natural* (gravity) ventilation will do the job. In thousands of industrial and commercial buildings Swartwout AIRMOVER and Swartwout-Dexter HEAT VALVE move enormous quantities of heat, smoke and fumes at *no after-installation cost* except small maintenance. And original cost is economical per square foot of opening. . . . It pays you to get Swartwout help on your ventilating problems. Write for Bulletin 344F.



The HEAT VALVE

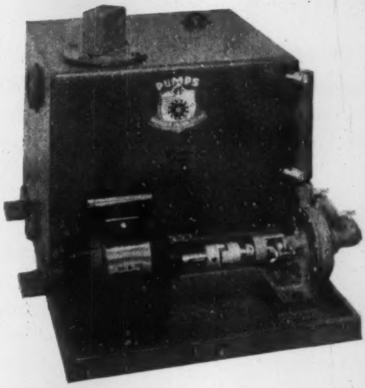
18568 Euclid Avenue, Cleveland 12, Ohio

The Swartwout Co.

Roof Ventilators and Ventilating Louvers

POWER PLANT EQUIPMENT • PROCESS INDUSTRY CONTROLS

Here's A Real Buy in CONDENSATE PUMPS!



The Eagan Eagle is your best buy from a performance, construction and price standpoint. It provides far more capacity than any similar pump at the same price . . . sells for only $124.00 (trade price F.O.B. Phila.)

Look at These Outstanding Features:

1. A low return inlet eliminates need for a pit even though return lines are as low as a foot above the floor
2. Capacity to 8000 sq. ft. EDR at 20 psi is obtained
3. The all bronze centrifugal pump has a non-clogging open impeller, stainless steel shaft, life sealed bearing
4. Flexible connectors and coupling isolate the pump, eliminate pipe cramp, misalignment, wear and noise
5. Thermal overload protection is provided
6. Base is heavy structural steel, drip-lip type with a 1/2" ips drain
7. Motor is standard 1/4 hp, 115 volt, quiet capacitor type
8. A level indicating float switch is provided

Other models are available with capacities to 100,000 sq. ft. at 200 psi. Mail coupon today for free descriptive literature.

WALTER H. EAGAN CO., INC.

Mfrs. of Condensate, Vacuum, Turbine, Boiler Feed, Centrifugal and Proportioning Pumps and Fuel Oil Pump & Heater Sets.

Pump Specialists Since 1920

2336 Fairmount Ave., Phila. 30, Pa.

Send me literature and information on pumps I've checked.

☐ Condensate
☐ Vacuum
☐ Turbine
☐ Boiler Feed
☐ Centrifugal
☐ Proportioning
☐ Fuel Oil Pump & Heater Sets

NAME ....

COMPANY ....

ADDRESS ....

CITY .... ZONE ..... STATE ....

WE HEAR THAT

Continued

▶ Officials of *WHEELING STEEL CORP.* recently attended ceremonies at Philadelphia marking the first arrival in the United States of iron ore from the Labrador-Quebec development. This was the first cargo of ore via the St. Lawrence River and the Atlantic Ocean to an east coast port.

▶ The board of directors of the *YORK CORP.* has appropriated almost $4 million for retooling its two plants in York, Pa.

▶ The *BABCOCK & WILCOX CO.* has signed a contract to furnish two heat exchangers for the first full-scale nuclear power plant ever built in the United States. The contract is with Westinghouse Electric Corp., which has responsibility for the nuclear portion of the project under an agreement with the AEC.

▶ Three students have received scholarships to Carnegie Institute of Technology from *ROBERTSHAW-FULTON CONTROLS CO.*

▶ A new $1 million manufacturing building in Louisville houses the production facilities for "Amerglas" furnace and air conditioning filters. According to *F. ROBERT WALKER*, sales manager for this division of *AMERICAN AIR FILTER CO., INC.*, the plant enables doubling former production. The new plant's location on a 32 acre tract allows for further expansion.

▶ A factory technical sales school was conducted recently by *McQUAY, INC.* at its Minneapolis plants for several field sales engineers. Discussed was the sale of evaporator and condenser coils used in self contained air conditioning units.

▶ *CECIL WALTON*, Ohio district sales manager for *U. S. MACHINE DIV.* of *STEWART-WARNER CORP.* has been selected by the Indianapolis Sales Executives Council for its "Distinguished Salesman of the Year" award. This is the second straight year that a district sales manager of U. S. Machine Div. has been chosen for the award.

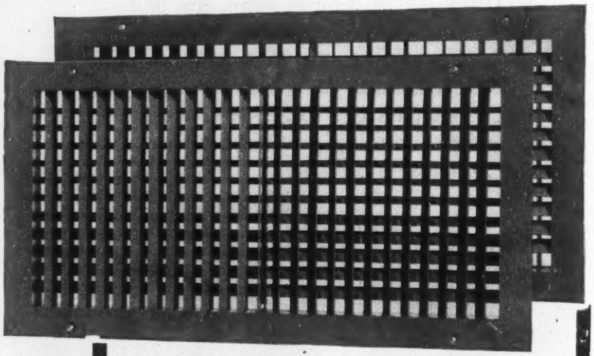
▶ *TYPHOON AIR CONDITIONING CO., INC.* has purchased a new factory building, adjacent to the present one in Brooklyn, N.Y., which will double the amount of floor space for manufacturing.

See This Sensational New Heating & Ventilating

GRILLE WITH DETACHABLE VOLUME CONTROL!

- **Increased Directional Control**
- **Eliminates Possibility of Tampering or Accidental Changes**
- **Meters Air-flow Accurately**

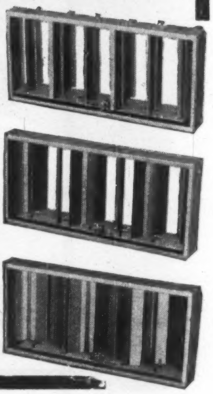
A-J



New features never before available . . . increased directional control, tamper-proof regulating, unmatched beauty, rugged strength and extreme ease of installation.
Extruded aluminum vanes are individually adjustable. Their unique shape provides greater directional control, and reduces air resistance to a minimum. This means more accurate balancing.
Each vane individually controlled. Operates under spring-loaded tension, eliminating any possibility of deflection pattern being altered by accident or tampering.
Fully-enclosed, wrap-around frame makes grille sturdier, assures easier, safer installation. Entire mechanism is concealed eliminating possibility of "air leaks".
Series "400" A-J Grilles (with — or without volume control) available in any size. Choice of vertical or horizontal louvers only — or combination of both, with either louver in front. Both sets of louvers adjustable without removing grille. Available in prime coat, hammered bronze or metallic gray or any standard finish.

NEW DETACHABLE VOLUME CONTROL

Easy to operate. Accurately meters air-flow from a "Whisper" to a "Full Blast"! A volume control you can depend on! Meters the flow accurately at *every stage* — from fully closed to fully open. No "dead spots". Louvers move simultaneously in opposing directions. Gear-driven action. System may be balanced without removing outer grille. Available with grille, or can be quickly installed later.



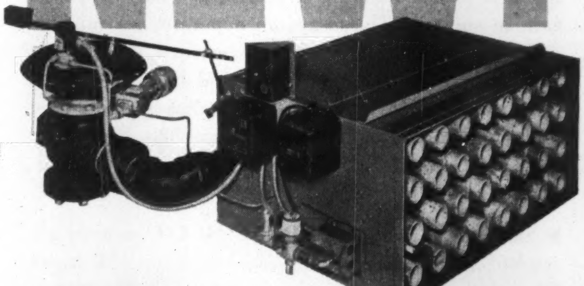
For More Information — Call or Write

A-J MANUFACTURING CO.

2119 Washington St. Dept. H9 Kansas City 8, Mo.

Matching Return Air Grilles Available

NEW!



MULTURI

(Multiple Venturi)

GAS BURNER

Especially designed for . . .

HARD-TO-FIRE
- **SCOTCH MARINE BOILERS**

HARD-TO-FIRE
- **STEEL FIRE BOX BOILERS**

AT HIGH FIRING RATES AT HIGH EFFICIENCY!

A Premix Type Gas Burner, ideal for commercial and industrial size boilers and warm air furnaces. Gives maximum performance from hard-to-fire Scotch Marine and steel fire box boilers. Flame characteristics make the burner a natural for units with extensive refractory surface. Suitable for any gas at 4" gas pressure or more. Permits high firing rates at high efficiency. Simple to install, adjust, and operate. Completely Factory Wired and Assembled . . .
Ready for Immediate Installation !

MULTURI BURNERS are available in standard modular units of 6 to 54 mixers. Capacities from 1,200,000 to 10,800,000 BTU/hr. Special units of higher capacities can be furnished. *Write or phone us for detailed information.*

Also Available — Nordensson Power Burners and Combination Gas-Oil Burners.

INDUSTRIAL GAS EQUIPMENT DIVISION
CODE OF ETHICS SIGNER
GAS APPLIANCE MANUFACTURERS ASSOCIATION
SIGNER NO. 12

ROBERTS-GORDON APPLIANCE CORP.
DEPARTMENT HPAC • BUFFALO 6, N. Y.
Conversion Gas Burners • Gas Heating Equipment

NEW

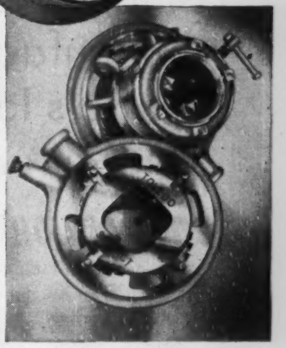
Improved TOLEDO Simpact

1" to 2" Self-Contained Ratchet Threader

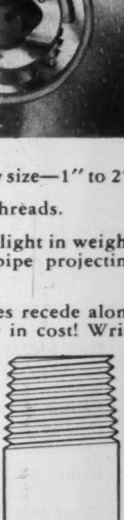
NO
0
TOLEDO
SIMPACT
TOLE

WITH

CAM-TYPE PIPE HOLDER



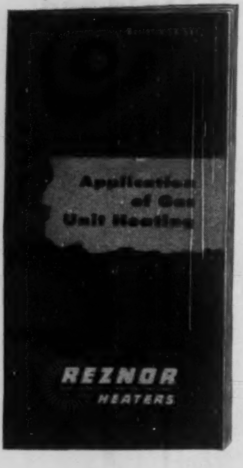
- ★ *Improved* cam-type quick-action pipe holder has broader jaws for more positive grip on pipe.
- ★ Free action cam assures instant setting to any size—1" to 2".
- ★ Easy to center . . . you get perfect aligned threads.
- ★ Fewer moving parts . . . minimum wear . . . light in weight. Amazingly compact . . . will thread a pipe projecting through a wall as short as 6¼".
- ★ Accuracy proven through the years . . . dies recede along tapered steps. A fine quality tool—yet low in cost! Write for new catalog. Order through your supply house. The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.



RELY ON THE LEADER . . . *all the way!*

TOLEDO

**PIPE TOOLS . . POWER PIPE MACHINES
POWER DRIVES**



the where when why how of gas unit heater applications

Table of Contents
What Is A Unit Heater
How Gas Unit Heaters Cut Heating Costs
When to Use Gas Unit Heaters
Types of Unit Heaters
How Reznor Heaters Work
Appraising the Job
Estimating Heat Loss
Short Cut Heat Loss Estimating Factors
Selecting the Right Heaters
Optional Equipment
Reznor Heater Features, Construction Details and Specifications
Unit Heater Coverage
Unit Heater Location
Temperature Controls
Venting
Computing Gas Line Requirements

compiled for you by the manufacturer of the world's largest-selling gas unit heater

Send for your free copy today

REZNOR
THE WORLD'S LARGEST-SELLING GAS UNIT **HEATERS**

REZNOR MANUFACTURING COMPANY
51 UNION ST., MERCER, PA.

Please send me a copy of your new bulletin, "Application of Gas Unit Heating."

Name__________ Title__________
Company__________
Street__________
City__________ Zone_____ State__________

WE HEAR THAT

Continued

▶ *INFRA INSULATION, INC.* is offering its "Joist-Space Heat-Tester" for two weeks' free use to members of the building industry interested in minimizing heat loss in building structures in winter and heat gain in summer. The tester, an apparatus for making comparative heat flow tests of various thermal insulations, simulates actual joists and building spaces. Inquiries, written on business letterheads, should be addressed to Infra Insulation, Inc., 525 Broadway, New York 12.

▶ Salesmen for the *C. A. DUNHAM CO.* recently attended a two-week school session at the Michigan City, Ind. plant. The curriculum included construction, design and application of steam and hot water heating and cooling equipment.

▶ Production has begun at *WHEATLAND TUBE CO.'s* new mill in Delair, N. J. Electric welded steel tubing is produced there.

▶ *BLACK & DECKER MFG. CO.* has established two scholarships, one at Johns Hopkins and one at Lehigh. Recipients will be selected by the universities from students majoring in mechanical, electrical or industrial engineering.

▶ *BADGER MFG. CO.* has installed a new 600 ton hydraulic press for forming the corrugated members of its line of expansion joints. It produces hydraulically formed corrugated bellows up to 72 in. in diameter.

▶ *HAJOCA CORP.'s* branch in Germantown, Pa., recently was the site for the *C. A. DUNHAM CO.* traveling road show. *S. MUIR STROH*, newly elected Hajoca vice president, and *WALTER S. BROWNING*, newly elected Dunham vice president, were the leading representatives for each company at the show. The trailer, which has been on the road since the beginning of the year, contains cutaway and operating models of steam and hot water heating equipment.

▶ The *LIMA ELECTRIC CO.* has purchased a fleet of station wagons fitted out as traveling displays to exhibit its line of industrial motors and gearshift drives. The station wagons will tour various sales territories and will return to the factory periodically to be refitted with another group of models.

▶ An $8 million expansion program is now underway for the *UNION MALLEABLE MFG. CO.* Under construction now is a new foundry at Ashland, Ohio.

Sterlco® CONDENSATE PUMPS
Engineered to the job!

COMPACT DESIGN
Large capacity tank provides plenty of condensate storage in a minimum floor space. Low inlet and all over simplicity of design eliminates unnecessary gadgets and excessive weight.

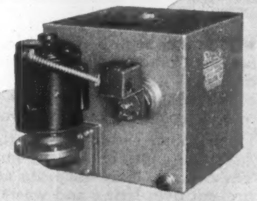
MOTOR
Vertically mounted—capacitor type. Dynamically balanced, permanently lubricated with automatic thermal overload.

FLOAT SWITCH
New, rugged, positive action float switch — easily adjustable to suit the requirements of a specific installation. Float switch and motor wired.

SERIES 4200
Cast iron tank

ROTARY SEAL
Good for thousands of hours of normal service — keeps corrosive condensate from motor shaft.

BRONZE IMPELLER
No close clearances — no shimming or adjustment.



SERIES 4100
Steel tank — same operating features

and EASY TO STOCK!
Only two sizes required to take care of jobs up to 15,000 sq. ft. E.D.R. — and up to 20 lbs. discharge pressure. *For you* this means less working capital tied up in floor stock. *For your customers* this means future increase in radiation may not require a new pump.

Sterlco Products
Distributed through
LEADING HEATING and PLUMBING WHOLESALERS

STEAM HEATING is MODERN, EFFICIENT and DEPENDABLE

STERLING, INC.
3732 N. Holton St., Milwaukee 12, Wisconsin

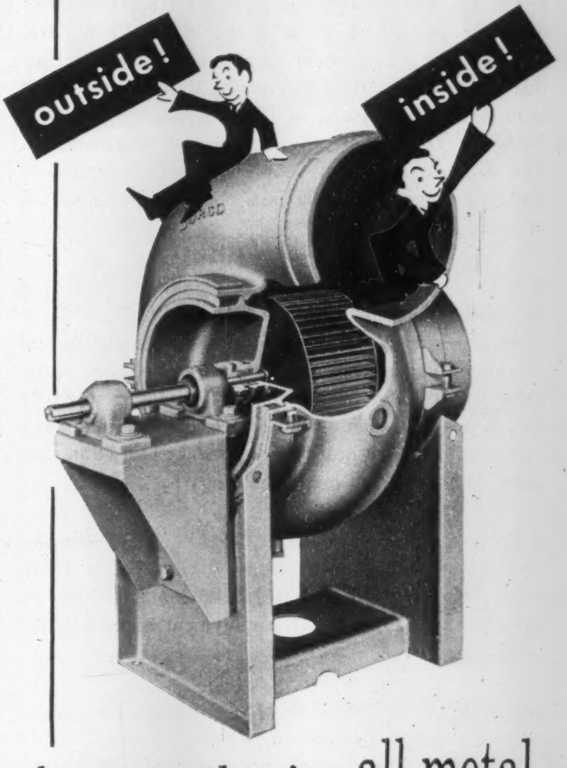
CONDENSATION AND VACUUM PUMPS

HEATING SPECIALTIES

TEMPERATURE CONTROLS

---

corrosion-proof


outside!
inside!
DURCO

because they're all metal

DURCO CORROSION RESISTING ALLOYS & EQUIPMENT **exhaust fans**

Duriron casing with Durimet 20 multiblade rotor provide the corrosion resistance users have a right to expect when they specify fans to handle acid fumes.

New Durco fans are not only completely acid proof, but they've been completely redesigned for reduced weight and cost.

Install Durco exhaust fans for permanent service in industrial plants, schools, laboratories and hospitals.

Mail the coupon for details!

The Duriron Company, Inc.
Dept. HP, Dayton, Ohio
Please send Bulletin on Durco Fans.

Name ____________________
Company ____________________
Address ____________________
City ____________ State ____________

WE HEAR THAT

Continued

▶ The U. S. Air Force has awarded a $500,000 contract for portable heaters to the *AMERICAN AIR FILTER CO.*, supplementing an order placed earlier this year for more than $1 million. Manufacture of the heaters will take place in the company's *HERMAN NELSON DIV.* plants in Moline and Morrison, Ill. The division has been supplying heaters similar to the type specified in the new contract for a period of two years.

▶ Within one month after a $500,000 fire destroyed two production plants of *YORK-SHIPLEY, INC.* at York, Pa., new production facilities were set up and complete line production of oil and gas heating equipment was re-established. Permission was granted by the Army for turning over one of the company's ordnance plants to heating equipment production, and other facilities were leased in a nearby building.

▶ *FRANKLIN ELECTRIC CO., INC.*, has awarded contracts for the construction of an addition to its main plant at Bluffton, Ind. It will double the size of the plant and provide for employment of up to 1000 people.

▶ *KAIGHIN & HUGHES, INC.*, Toledo mechanical contractor, has been awarded a contract for more than $81 million on three contracts for the Atomic Energy Commission's installations at Oak Ridge, Tenn. The contracts are for the expansion of the first two gaseous diffusion plants built at Oak Ridge. The firm will handle the planning, engineering and installation of industrial piping, ventilating, heating, plumbing and all sheet metal work.

▶ The *JOHNSON SERVICE CO.*, Milwaukee, recently purchased a building in Atlanta, Ga., to provide more space for its headquarters office serving Georgia, Alabama and Florida. The completely air conditioned building at 489 Bishop St., N. W., includes offices, warehouses and shops.

▶ The *DU PONT CO.* has acquired options on land in California for the construction of a plant for the manufacture of tetraethyl lead and "Freon" refrigerants.

▶ A tabloid newspaper, emphasizing heating news, is being published by *CRANE CO.* Called the *Crane Sunnyday News*, it carries selling ideas for heating contractor-dealers and news of advances in the heating field. A regular feature is a market outlook column which contains analyses of the future in commercial, school and residential construction.

Now you can enjoy all the Wonderful Benefits of Combustioneer MODULATING STOKERS at Installation Savings Up To $500.00 per Stoker

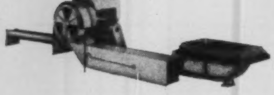
• The reason for the savings is quite simple! The famous Combustioneer "Type L" Gear Drive is "made to order" for Modulating Controls. Its adaptation to Modulating Controls is much less costly . . . savings up to $500 per stoker are not uncommon.

Furthermore, with Combustioneer's Modulating Controls you continue to save important money every day. The controls level off peaks and valleys in coal feeding, prevent over-firing and waste of coal! They keep more heat in the boiler, reduce stack losses, use less fuel during "off" periods, save operator's time and assure smoke-free stacks. They accomplish all this by *automatically* feeding coal and air to the fire at *variable* rates to meet exact load requirements.

Combustioneer Modulating Stokers range in capacity from 200 to 1000 lbs. per hour. Their rugged construction assures long life in hard service. They are available in both Hopper and Bin-Feed Models.

Write today for Architect's Heating Manual containing complete Combustioneer data and specifications.

Combustioneer Division
The Steel Products Engineering Company
1375 W. Columbia St., Springfield, Ohio


Bin-Feed Model No. 20

Hopper Model No. 50

Combustioneer

Gas Burners • High and Low Pressure Oil Burners
Oil Furnaces • Stokers • Humidifiers

when in the dark...
Look to

Stewart

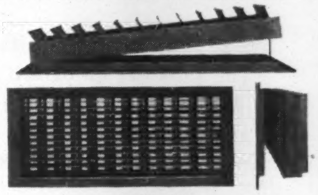
for Outstanding New Advances in

Air Conditioning Outlets

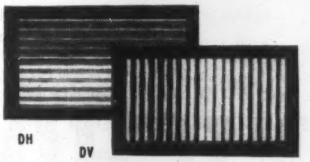
REGISTERS
GRILLES
SCOOPS
by
Stewart

In this Complete Catalog . . .

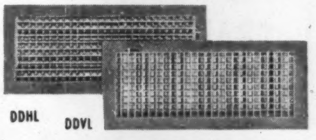
For Quality, Originality, Economy and Fast Delivery—your best choice is Stewart for Industrial and Commercial Registers — Grilles and Air Controls. You'll find one to suit your every need in the new 28 page Catalog #53.



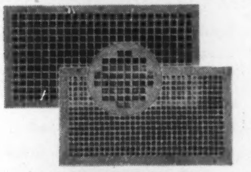
SCOOPMASTER
Eliminates sheet metal collar—directs and controls air



SINGLE BANK OUTLET



Triple Bank Registers Individually Adjustable Fins



PLAIN LATTICE GRILLES

SCOOPTROL
Deflects and controls the air from a supply duct into a collar

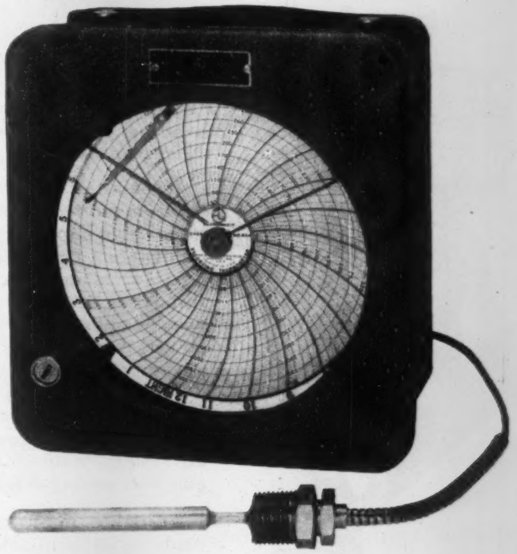
Opposed-Action Valves
optional with all Supply and Return Air Registers.

Stewart
MANUFACTURING CO., INC.
Grove Ave., Essex County, Cedar Grove, N. J.
2241

Representatives in the Principal Cities of United States, Canada and the West Indies.

For Eye-Level Readings...

AUTO-LITE

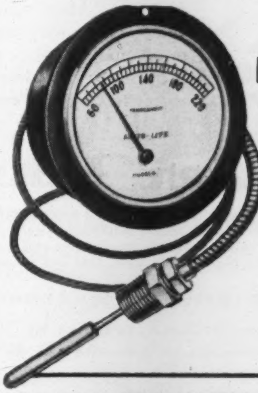


Model 1000

TEMPERATURE RECORDER

This newly designed recorder has evenly calibrated, 6-inch chart . . . attractive die-cast case. Various standard ranges from minus 40°F to plus 550°F. Illustrated above is portable type, with capillary tubing for remote reading. Also available for mounting on panel boards or walls. 24-hour or 2-day electric or mechanical chart drive. Obtainable with a cycle indicator for refrigeration.

Priced from $49.50



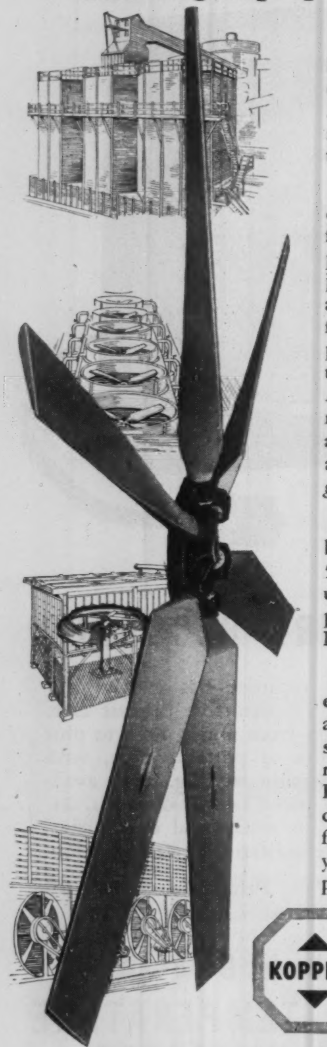
Model G

TEMPERATURE INDICATOR...

Wide selection of dial ranges. Various mountings to meet your needs. Send for new catalog of Auto-Lite Recording and Indicating Thermometers.
Priced from $18.

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
TOLEDO 1, OHIO
NEW YORK • CHICAGO • SARNIA, ONTARIO

Here's Why Aeromaster Fans mean more satisfactory cooling equipment operation



Manufacturers and users of cooling equipment agree . . . Aeromaster Fans give outstanding service. Here are the reasons why.

Aeromaster Fans are *precision-engineered,* adapted from high speed aircraft propellers. They have adjustable blade pitch and anti-flutter design . . . therefore, require less horsepower. And they last longer too, thanks to the exclusive Aeroloid blade coating to resist acids and alkalies, abrasion and weather. Overall result: Aeromaster Fans *give more cooling at lower cost.*

Available in 4, 6, or 8 blade styles, in diameters of 5 to 24 ft., with capacities up to 1,000,000 cubic feet per minute, all Aeromaster Fans are fully guaranteed.

Koppers also has trained engineering specialists available in principal cities, insuring prompt, expert Aeromaster Fan service. And Koppers is always ready to consult with you on special fan problems. Next time you plan a replacement of present fans, specify Aeromaster. And when you consider new equipment, call on Koppers . . . always eager to be of service.

KOPPERS

Aeromaster Fans

METAL PRODUCTS DIV. • KOPPERS COMPANY, INC. • BALTIMORE, MD. • This Koppers Division also supplies industry with Fast's Couplings, American Hammered Industrial Piston and Sealing Rings, Koppers Electrostatic Precipitators, Gas Apparatus. Engineered Products Sold with Service

MAIL COUPON TODAY FOR COMPLETE INFORMATION

KOPPERS COMPANY, INC., *Aeromaster Fans,* 249 Scott St., Baltimore 3, Md.

Gentlemen: Please send me detailed information on Aeromaster Fans for

....

(name and type of equipment to be cooled)

Name..

Title........................Company..............................

Address..

City........................Zone......State.....................

NEW BOOKS & REPORTS . . .

Plant Maintenance

Techniques of Plant Maintenance & Engineering—1954, the annual volume containing the proceedings of the Plant Maintenance and Engineering Conference, was published recently by Clapp & Poliak, Inc. The book contains the texts of papers read by 24 authors, each followed by a series of questions and answers. A new feature this year is the summary of 20 roundtable discussions.

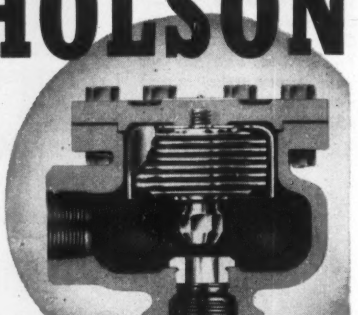
The book is sent without charge to those who attended the conference last January. Others may obtain it from Clapp & Poliak, Inc., 341 Madison Ave., New York, for $7.50.

Steel Piping Specifications

The 1954 edition of *ASTM Specifications for Steel Piping Materials* is a compilation in their latest approved form, of 53 ASTM specifications for carbon-steel and alloy-steel pipe and tubing, including stainless. Materials covered include pipe used to convey liquids, vapors and gases at normal and elevated temperatures; boiler, superheater and miscellaneous tubes; still tubes for refinery service; heat-exchanger and condenser tubes.

NICHOLSON

TRAPS for Every Plant Application



Send for Nicholson Catalog 953. This 32-page standard reference on advance-type trapping of steam, air and other mediums contains: installation diagrams, charts and formulae for determining proper trap sizes, and advice on solving specific problems. See why leading plants are increasingly standardizing on Nicholson traps for increased production and minimum maintenance.

Send for this Helpful Booklet

NICHOLSON
STEAM
TRAPS
CATALOG NO. 953
W. H. NICHOLSON & CO.
WILKES-BARRE, PA.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

198 Oregon St., Wilkes-Barre, Pa.

Send for This Useful Reprint Volume

"CORRECT PRACTICE in INDUSTRIAL PIPING"

— All-New Second Edition —

196 Pages — 8½" x 11" — $1.50

This practical book is made up of outstanding papers and data on industrial piping selected from past issues of "Heating, Piping & Air Conditioning." It is a most comprehensive collection of case studies, showing how various difficult piping problems encountered in different industrial plants were successfully worked out by piping experts.

Design, installation, operation, and maintenance . . . steam, air, gas, oil, process, water and refrigeration piping . . . piping in pulp and paper and steel mills, in automobile plants and breweries, in the food and chemical and textile industries, and in many other types of manufacturing plants are dealt with from many different angles.

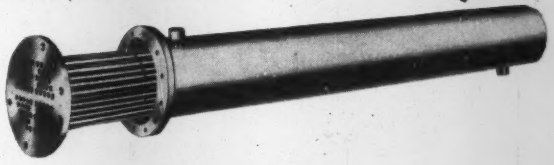
Send $1.50 today for this book to the address below.

KEENEY PUBLISHING COMPANY

6 North Michigan Ave. Chicago 2, Illinois

Taco HEAT EXCHANGERS

3 WAYS BETTER

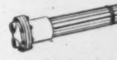


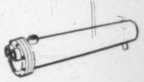
1. Designed for maximum operating efficiency and rapid heat transfer.
2. Built for optimum performance and life . . . expanded joints, electronically rolled, free of rubbing, noise or wear.
3. Engineered to suit your requirements by experienced Taco Field Engineers . . . who help you select exactly the right heat exchanger for your job from the wide range of units made by Taco.

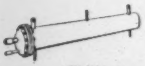
For complete information, write for "Taco Heaters" catalog containing Taco's "pin-point" Selection Charts.

Circulating Pumps

TACO HEATERS INCORPORATED
1160 Cranston Street
Cranston 9, R. I.







MINERALLAC
Perforated
STRAP
Versatile Hanger Iron

MINERALLAC

Safely supports hanging pipes, conduits and cables up to 500 lbs. Made of ¾-in. 18 gauge electro-galvanized steel (also available in Everdur, copper, brass or aluminum). Precision made—perforations do not vary. ¼-in. holes on ½-in. centers. Comes in 10-ft. coils and 5 and 10-ft. straight lengths. Available in other lengths also.

Send for literature and prices

Specify
MINERALLAC
HANGERS, CLIPS, STRAPS, BUSHINGS
MINERALLAC ELECTRIC COMPANY
23 North Peoria Street
Chicago 7, Illinois

MINERALLAC

In this compilation, 22 of the specifications included in the previous edition have been revised. Of this number, 17 are tentatives and five are standards. A new specification covers ferritic alloy steel forged and bored pipe for high temperature service.

Copies of this 370-page publication may be obtained from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, at $3.75 each.

Air Pollution and Health

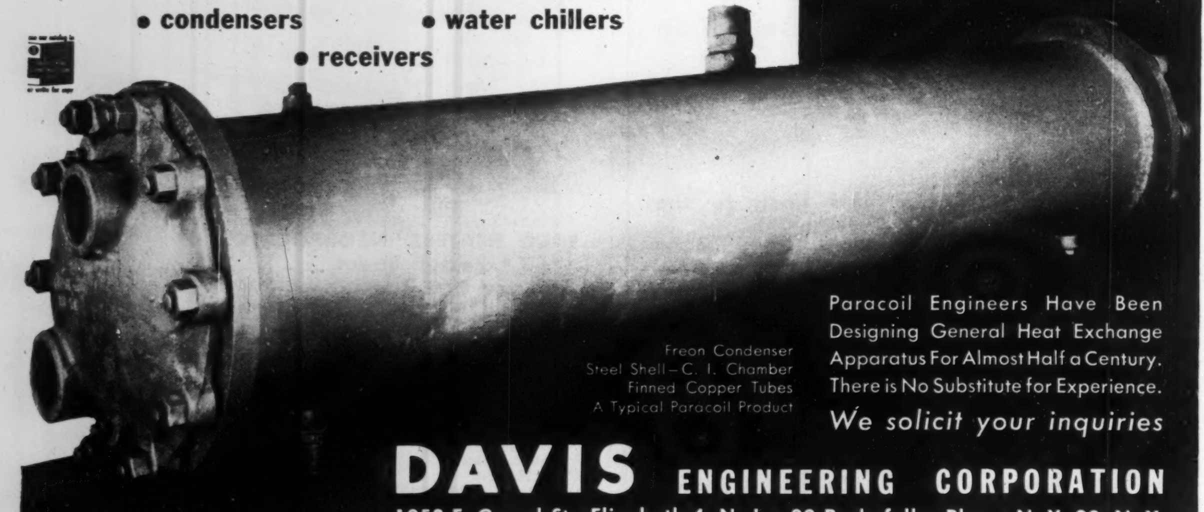
The hazards of air pollution in regard to public health are thoroughly explained in *Air Pollution and Community Health* by Dr. Clarence A. Mills, professor of experimental medicine at the University of Cincinnati. Dr. Mills, who has spent many years investigating the effects of air pollution on the populations of various industrial centers throughout the world, points out the duty of industry to control its pollution of community air and the need for proper legislation. Covered in graphic detail are the smog disaster at Donora, Pa. in 1948, and the statistics of respiratory troubles in industrial cities in the United States.

Priced at $2.75 a copy, it is published by the Christopher Publishing House, 1140 Columbus Ave., Boston 20.

Paracoil **Air Conditioning and Refrigeration Equipment**

PARACOIL Units For All Air Conditioning and Refrigeration
- **evaporators**
- **condensers**
- **brine coolers**
- **water chillers**
- **receivers**

SPECIAL DESIGNS FOR THE PROCESS INDUSTRIES
- Built for All Commercial Refrigerants
- Finned or Bare Tubes
- Straight or U Type Tubes
- Designed to Any Stationary or Marine Code



Freon Condenser
Steel Shell—C. I. Chamber
Finned Copper Tubes
A Typical Paracoil Product

Paracoil Engineers Have Been Designing General Heat Exchange Apparatus For Almost Half a Century. There is No Substitute for Experience.

We solicit your inquiries

DAVIS ENGINEERING CORPORATION
1058 E. Grand St., Elizabeth 4, N. J. • 30 Rockefeller Plaza, N. Y. 20, N. Y.

Perfex Controls

Save $600.00 per Month

in salaries alone

at Union School Of Christianity
Kansas City, Mo.

All over the country Perfex Industrial Instruments are effecting remarkable savings in fuel, labor, maintenance — like they are at the Union School of Christianity. Here's what they have to say about their Perfex system:

> *"Since we installed your equipment we have added over 18,000 square feet of new buildings, and still have a saving of 5% on our fuel consumption.*
>
> *In addition we have saved in labor two extra men's time or about $600 per month in salaries, and have had 24 hour trouble-free heating since installing this equipment."*

It will pay you too to check on Perfex Industrial Instruments for *your* heating system.

PERFEX

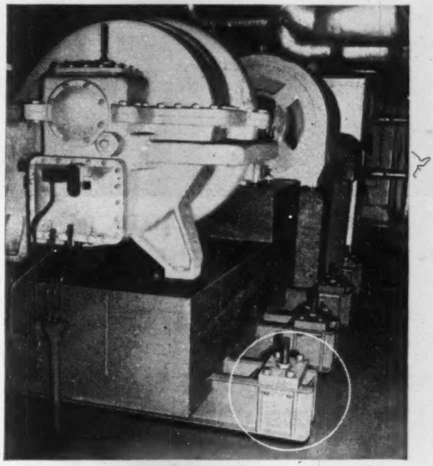
PERFEX CORPORATION
Executive Offices — Milwaukee, Wis.
Plant — Iron Mt., Michigan
PERFEX CONTROLS LTD. Toronto, Ontario, Canada

AUTOMATIC CONTROLS FOR HEATING • AIR CONDITIONING • APPLIANCES

In this "Drive-In" Office Building

KORFUND VIBRATION CONTROL *allows more rentable space*

A feature of the Cafritz Building in Washington, D. C., makes it possible to drive your car up a series of ramps, and park it outside your office door.



The Cafritz Building, *Washington, D. C.*
LeRoy L. Weiner *Architect*
William A. Brown *Consulting Engineer*
Cafritz Construction Company *Builder*
Mehring & Hanson Company *Mechanical Contractors*

Another feature is this 530 Ton Centrifugal Refrigeration Machine installed on the roof. Korfund Steel Spring Vibro-Isolators with adjustable leveling bolts (a Korfund feature for over 30 years) made this installation possible, since they completely prevent vibration and noise transmission even to floors directly below. This makes available more revenue-producing space elsewhere in the building.

This is just one of hundreds of successful upper floor installations of heavy air conditioning equipment on Korfund spring isolators. Only Korfund Vibro-Isolators allow really heavy upper floor installations without floor reinforcement and with positive assurance of vibration and noise control.

Utilize all possible revenue-producing space — move air conditioning equipment upstairs. Korfund experience makes it possible. There is no substitute for experience.

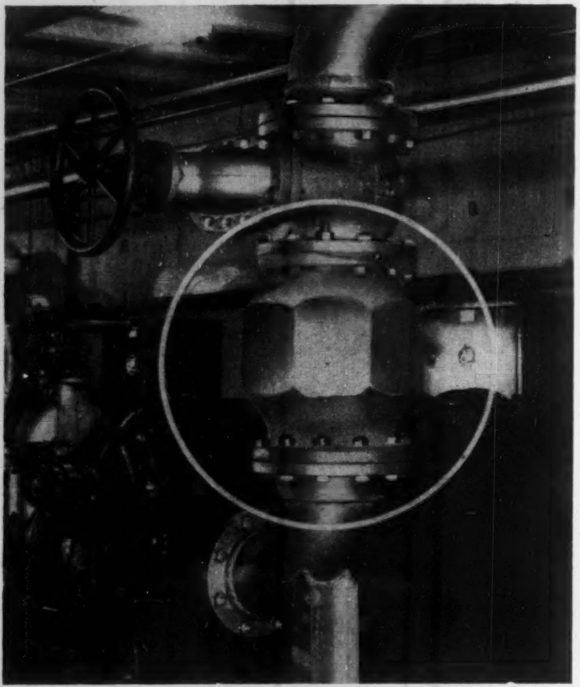
For more information, write for your copy of Bulletin 23, or see our catalog in Sweet's Files.

For specific recommendations, contact us or your local Korfund Office. Look under "Korfund" in your local Telephone Directory or Thomas' Register. A half-century of experience is at your disposal.

THE KORFUND CO., INC.

KORFUND VIBRATION CONTROL — SPRINGS — RUBBER — CORK

48-01F Thirty Second Place, Long Island City 1, N.Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal



10" MILLER VALVE INSTALLED IN MIDWESTERN DEPARTMENT STORE

MILLER

NOISELESS — NON-SLAM
CENTER GUIDED CHECK VALVE

SHOCK-PROOF
ELIMINATES WATER HAMMER

FULL RADIAL FLOW
MINIMUM PRESSURE LOSS
SIZES 1" THROUGH 24" FLANGED
SEMI-STEEL — CAST STEEL — ALLOYS
PRESSURES 125 LBS. TO 2500 LBS.
YOU CAN DEPEND ON A
MILLER CHECK VALVE
IT IS THE BEST

MILLER VALVE CO., INC.
P.O. BOX 1255
PITTSBURGH 30, PENNA.

Please send your Bulletin 153 Descriptive of Miller Shock Proof Center Guided Check Valves.

NAME AND TITLE ....
FIRM NAME ....
ADDRESS ....
CITY ....

MEETINGS & CONVENTIONS

INDUSTRIAL VENTILATION CONFERENCE, sponsored jointly by the New York State Labor Department's Div. of Industrial Hygiene and Columbia University—September 15-17, Columbia's Pupin Hall, New York City. The program has been designed to increase knowledge of industrial exhaust systems which comply with the New York State industrial codes. Additional information may be obtained from Prof. Carl F. Kayan, Dept. of Mechanical Engineering, Columbia University, New York 27.

NINTH INTERNATIONAL CONGRESS OF REFRIGERATION, Paris, August 31 to September 15—sponsored by the Institut International du Froid, 177 Boulevard Malesherbes, Paris 17.

FIRST INTERNATIONAL INSTRUMENT CONGRESS AND EXPOSITION—September 13-24, Comercial Museum and Convention Hall, Philadelphia. The meeting, sponsored by the Instrument Society of America, 1319 Allegheny Ave., Pittsburgh, will feature technical sessions on instrumentation and an exhibition of instruments and devices for measurement, inspection, testing and control. It will be held concurrently

to solve
SPRAY NOZZLE problems

get your free copy of
SPRAYING SYSTEMS CO. CATALOG NO. 24
48 pages of spray nozzle reference data . . . the most complete catalog of its kind ever produced.

let a
SPRAYING SYSTEMS CO.
sales engineer
help you
. . . his specialized experience is yours for the asking.

write to . .
SPRAYING SYSTEMS CO.
Engineers and Manufacturers
3219 Randolph Street • Bellwood, Illinois

The LEADERS!

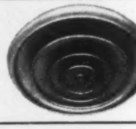
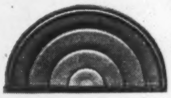
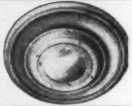
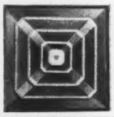
AIR DISTRIBUTION

CARNES

in style, quality and economy

Yes, Carnes leads with a line of diffusers that's way ahead! The best ideas and newest developments . . . beautiful styling . . . easy installation . . . complete adjustability are all incorporated to bring you top quality at low prices. Your best bet is Carnes!

A DIFFUSER FOR EVERY REQUIREMENT

MODEL		NECK SIZES	C F M OUTPUT	
E-1	Supply only fixed cone	5 to 32	50 to 13,400	
E	Supply only fixed cone	5 to 32	50 to 13,400	
EJ	Supply only adjustable cone			
ER	Supply and return fixed cone			
BR	Supply only adjustable cones	6 to 32	115 to 13,400	
BRS	Supply and return adjustable cones			
EH	Half Round Supply only fixed cone	6 to 20	50 to 2,725	
QSL	Combination diffuser and lighting fixture adjustable	8 to 17	210 to 2,670	
SFS	Supply only surface type fixed cone	8 x 8 to 20 x 20	150 to 6,925	
SFR	Supply only recessed type fixed cone			

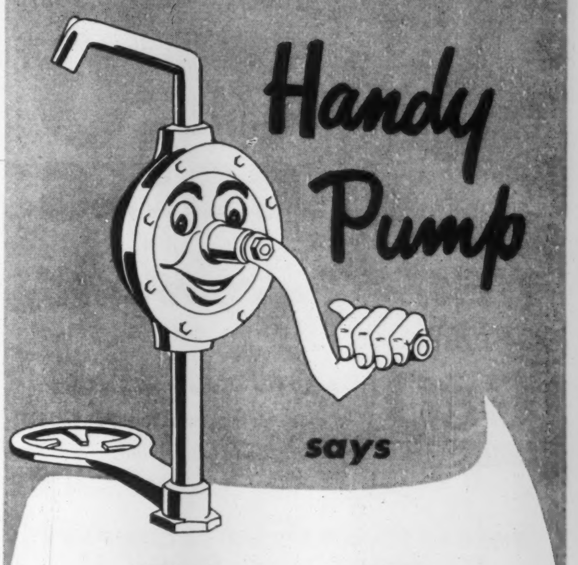
CARNES

Write today for Carnes descriptive literature, selection charts and engineering data!

The Most Talked About Name in Air Distribution

W. R. CARNES CO., VERONA, WISCONSIN

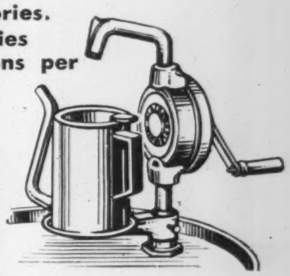
LIQUID MATERIALS HANDLING



"To keep your plant safe and clean use BLACKMER Hand Pumps"

Check these valuable features!

- ✓ **Easy rotary pumping action.**
- ✓ **Famous "Self-Adjusting for Wear" Design.**
- ✓ **Surplus liquid return eliminates spillage and waste.**
- ✓ **Positive displacement for positive control.**
- ✓ **Wide range of "plant engineered" accessories.**
- ✓ **Available in capacities from 7 to 28 gallons per minute.**



call your local representative or write the factory for information

liquid materials handling

BLACKMER

Industrial, Hand and Truck Pumps, Strainers, Pressure Control Valves
BLACKMER PUMP COMPANY, GRAND RAPIDS 9, MICH.
DIVISION SALES OFFICES — NEW YORK • ATLANTA • CHICAGO
GRAND RAPIDS • DALLAS • WASHINGTON • SAN FRANCISCO
See Yellow pages for your local sales representative

G&O COILS for HEATING and COOLING

G&O RADIATION

A full line of sizes now available to meet all industrial requirements. Send for catalog.

THE G&O MANUFACTURING COMPANY
New Haven 8, Connecticut
Pioneer Manufacturers of Square Finned Tubing in the United States

MEETINGS & CONVENTIONS

Continued

with the Fifth Annual Instrument Maintenance Clinic and the Third Annual Analytical Instrument Clinic. Richard Rimbach, 845 Ridge Ave., Pittsburgh, is managing director.

REFRIGERATION SERVICE ENGINEERS, AZALEA CITY CHAPTER—September 25, Admiral Semmes Hotel, Mobile, Ala., fall education meeting. Requests for reservations should be mailed to K. J. Dixon, P.O. Box 1009, Mobile.

AMERICAN GAS ASSOCIATION, 420 Lexington Ave., New York 17—36th annual convention, October 11-13, Atlantic City, N.J. Programs are being arranged for the association's Operating Section, Accounting, Home Service, General Management, and Industrial and Commercial Sections.

EIGHTH NATIONAL CHEMICAL EXPOSITION, The American Chemical Society, Chicago Section, 86 E. Randolph St., Chicago 1—Chicago Coliseum, October 12-15. Theme of the exposition is "The Chemical Industry in Everyday Living."

Phoenixspun FABRICATING...

Solves Production-Forming Problems Like This—

SPINNING "jumbo" sized forms like this inlet bell for a large ventilating blower is no problem the PHOENIXSPUN way! — A rolled and welded sheet of 14-gauge steel becomes an inlet bell 24" deep and 72" in diameter, under the skilled hands of master craftsmen. Large or small, your special forming needs can be served as readily.

METAL SPINNING

WELDING
(Inert Gas, Arc, Oxy-Acetylene)

DEEP DRAWING
(To 350 Tons)

FABRICATING

ASSEMBLING

WRITE for Illustrated Bulletins, or send prints and specifications for prompt quotations.

Metal Spinning Div., **PHOENIX PRODUCTS CO.**

4707 N. 27TH STREET • MILWAUKEE 16, WISCONSIN

THE
LOW COST
WAY TO HEAT
WITH GAS

Lo-BLAST Economite Gas Conversion Burner

LO-BLAST

POWER-TYPE GAS CONVERSION BURNER

CAPACITIES 70,000 TO 20,000,000 BTU INPUT

Regardless of the size of the heating plant, Lo-BLAST Gas Burners deliver more heat per fuel dollar. In 19 years of actual operation, these power-type units have consistently cut fuel and service costs.

Because primary and secondary air is perfectly controlled from a blower source, the Lo-BLAST Burner is independent of variable natural draft. Hence it is particularly well suited for downdraft boilers. Combustion is completed in an incandescent firebox, with radiant heat applied to crown sheet as well as side walls.

Other features include soft, quiet flame . . . standard controls with positive acting pilot and blower safetys . . . sturdy, fool-proof design . . . easy to install because completely assembled and factory-tested on gas . . . competitively priced.

A Lo-BLAST dealership is profitable! Complete range of capacities and a nation-wide reputation for economy make this burner a strong seller. Write for information.

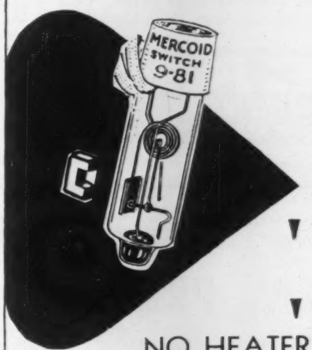
The standard Lo-BLAST Gas Conversion Burner

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

TIRED OF THERMOSTAT REPLACEMENTS?

IT'S TIME TO
SWITCH
TO THE

MERCOID SENSATHERM



With Its

MAGNETIC MERCURY SWITCH

NO HEATER PROBLEMS

The Mercoid magnetic mercury switch plus other engineered components eliminates internal heaters, thus no calculations or adjustments are required.

NO INVENTORY PROBLEMS

One standard type Sensatherm will operate all basic primary controls.

NO CONTACT CLEANING

The Mercoid magnetic mercury switch has proven its dependability throughout the past twenty years by providing millions of "makes" and "breaks" without any sign of deterioration.

The Mercoid Sensatherm builds customer goodwill by eliminating service and replacement calls. Specify it for your next job.

Available for
Heating
Air Conditioning
Refrigeration

THE MERCOID CORPORATION
4201 BELMONT AVENUE, CHICAGO 41, ILLINOIS
New York, 205 East 42nd Street • Philadelphia, 317 North Broad Street

*REG. U. S. PAT. OFF.

ALL MERCOID CONTROLS INCORPORATE SEALED MERCURY CONTACTS

"our 4 'BEAR' DY-NAMIC BALANCING machines turn out 1000 pieces a day... each balanced to our tolerance in less than two minutes!" says Thompson Morrison, Vice-President of Morrison Products, Inc., Cleveland, Ohio. Shown are two of the four "Bear" Dy-Namic Balancing Machines which have been in operation here since 1945.

"We found that Dy-Namic Balancing of cooling fans reduces vibration, lessens bearing wear and noise, and results in greater customer acceptance of our products."

"When blower wheels are balanced STATICALLY only, DY-NAMIC unbalance is often increased . . . that's why we use the 'Bear' method, which takes care of both static and dy-namic balance in one operation."

Like hundreds of other industrial plants, Morrison Products Company has discovered that "Bear" Dy-Namic Balancing Machines attain high standards of accuracy at favorable production rates and with minimum capital investment. Reduce noise, vibration, friction, bearing failure thru Dy-Namic Balancing. **FREE MANUAL** shows how! Write: Bear Mfg. Co., Dept. H-16, Rock Island, Ill.

6069

"BEAR"

STATIC AND DY-NAMIC BALANCING MACHINES
balance rotating parts weighing from 4 oz. to 8 tons

MEETINGS & CONVENTIONS

Continued

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 1061 M & M Bldg., Houston—meeting of South Central Region, October 14-15, Dallas. Symposia will be presented on cathodic protection, protective coatings, inhibitors, processing plant corrosion problems, pipe line corrosion and oil and gas production.

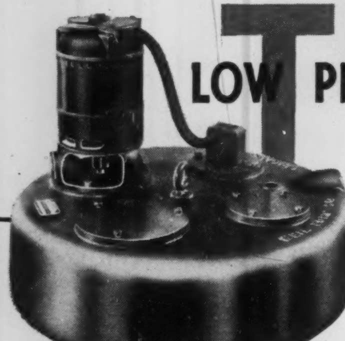
NATIONAL SAFETY CONGRESS AND EXPOSITION, October 18-22, Conrad Hilton Hotel, Chicago—sponsored by the National Safety Council, 425 N. Michigan Ave., Chicago 11. More than 200 sessions are planned to discuss the latest advances in accident prevention.

PLASTICS IN BUILDING, conference stressing the importance of plastics in residential, industrial and institutional construction—October 27-28, National Academy of Sciences, Washington, D.C. Sponsors are the Society of the Plastics Industry, Inc., the Manufacturing Chemists' Association and the Building Research Advisory Board.

TVC Condensate Pumps

LOW PRESSURE SYSTEM

LOW RETURN CONNECTION
LOW SPEED, LONG LIFE
CAST IRON RECEIVER
SINGLE OR DUPLEX



A SINGLE UNIT easily converted at any time to a DUPLEX UNIT

Specify the "Convertible" TVC in the 15 gallon receiver when ordering low pressure system condensate pumps.

Capacities from 500 to 10,000 sq. ft. E.D.R.

Available from Jobbers' Stock

The Single Unit TVC Condensate Pump in a 15 gallon receiver can be converted to a DUPLEX UNIT whenever load or other conditions require. Each receiver is furnished machined and drilled for the addition of another pump and control.

Conversion to a Duplex Unit doubles the capacity of the unit, or where desired, provides a stand-by pump. Additional pump is installed right on the job. Removal of the unit is unnecessary.

- **Dimensions**
  15 gallon cast iron receiver for single or duplex units: diameter 25½", height of return above floor—7$\frac{3}{16}$".
  10 gallon cast iron receiver (for single units only): diameter 21", height of return above floor—6⅞".

- **Features**
  TVC Condensate Pumps are low speed (1750 RPM) for long life, are readily installed in area where space is important. Their compact cast iron receiver and sturdy pumping unit assure a trouble free installation.

- **Installation**
  Simple installation consists of connecting return line to receiver, and connecting discharge to boiler, using a check valve and a gate valve. Unit is completely assembled at the factory. Send for Bulletin TVC300.

weil PUMP CO. 1514 N. FREMONT ST. • CHICAGO 22

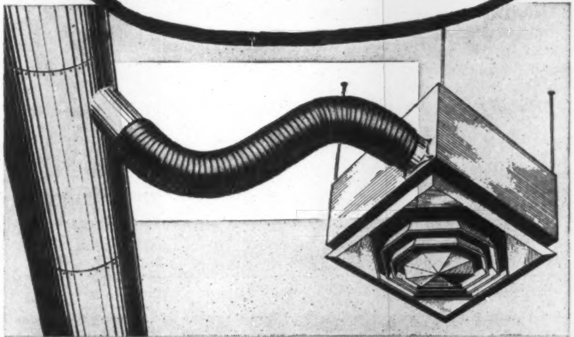
√ SPECIFY

WIREMOLD

FLEXIBLE

AIR-DUCT

for Commercial Air Conditioning systems

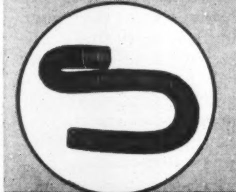


√ EASY to INSTALL!
√ SAVES Time and Money!
√ INCREASES Efficiency!

The flexibility and lightness of WIREMOLD Flexible AIR DUCT save time and money on installation. It can be cut to length easily and quickly. All sizes are produced within exact tolerances, assuring a snug fit.

Wiremold's combination of tested materials and exclusive construction assures long life. There is no glue or adhesive to dry out or crack, because a specially coated Fibreglas is *mechanically locked* into the supporting steel spiral.

WIREMOLD AIR DUCT type 571A was developed specifically for flexible connections on high velocity systems. It provides an airtight connection which dampens mechanical vibration and allows for expansion and contraction.

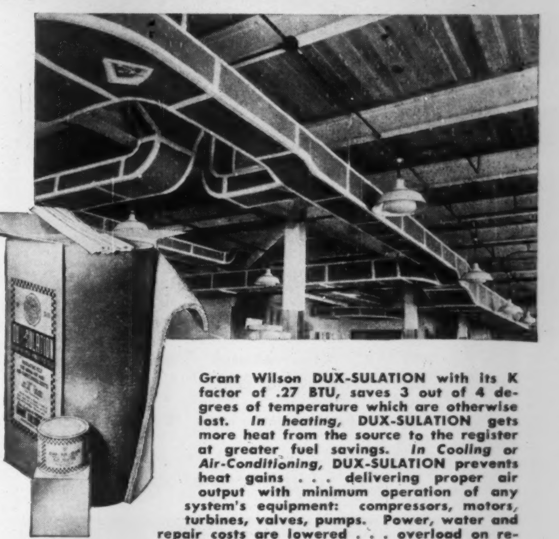


WIREMOLD Flexible AIR DUCT has been tested in the laboratory and proved on the job. It is recommended by leading makers of air distribution equipment.

Get the complete story on WIREMOLD Flexible AIR DUCT. Write for Data Sheet S-3.

The WIREMOLD Company
HARTFORD 10, CONNECTICUT

STOP *Temperature Loss!*



Grant Wilson DUX-SULATION with its K factor of .27 BTU, saves 3 out of 4 degrees of temperature which are otherwise lost. *In heating,* DUX-SULATION gets more heat from the source to the register at greater fuel savings. *In Cooling or Air-Conditioning,* DUX-SULATION prevents heat gains . . . delivering proper air output with minimum operation of any system's equipment: compressors, motors, turbines, valves, pumps. Power, water and repair costs are lowered . . . overload on refrigeration equipment relieved.

Other Advantages of Dux-Sulation on Duct Work: Condensation Prevention, Sound Absorption, Lower Surface Friction, Permanence, Good Appearance, Economy of Installation, Dependable Safety.

STOP *Noise!*

Grant Wilson Woven Asbestos FLEXI-DUCT Tape stops noise and vibrations in all duct systems by isolating them at their source. Mechanical rattles, starting and stopping screeches, shaft whine, fan hum . . . all natural attendant noises to a blower' operation . . . can be confined to the blower housing by incorporating a flexible joint made of FLEXI-DUCT tape. Installation of such a joint is simple . . . tape or bolt FLEXI-DUCT to equipment and duct work with little time and effort. Network of ducts can be easily sectionalized . . . positively precluding sound travel by conduction . . . by interspersing FLEXI-DUCT joints throughout.

USED IN STORES • OFFICES • HOSPITALS • THEATRES • INDUSTRIES • HOMES

Write Today for Free Sample Kit (No. 549-H)

Grant Wilson inc.
ASBESTOS and INSULATING MATERIALS
141 WEST JACKSON BLVD. • CHICAGO 4, ILLINOIS

UNIVERSAL

Flexible

METAL HOSE PRODUCTS

For all industrial requirements

- **Exhaust**
- **Blower Hose**
- **Suction**
- **Fume Collection**
- **Pressure Hose**
- **Fittings**

METALS: Galvanized Steel, Stainless Steel, Bronze and Brass.

Send for Technical Data Book U-111

(No obligation, of course)

UNIVERSAL METAL HOSE CO.

2117 South Kedzie Avenue
Chicago 23, Illinois

A LOT OF PUMP
IN A LITTLE PACKAGE!

BJ NEW FRACTIONAL HORSEPOWER BILTON PUMPS

...WITH BJ MECHANICAL SEAL AS STANDARD EQUIPMENT!

Meet the mighty midgets of the BJ Bilton family. They offer capacities up to 100 GPM and heads up to 100 ft. . . . yet the largest measures only 16 inches in length! Mount in any position . . . need no base plate . . . pump case may be rotated for horizontal or vertical discharge . . . no stuffingbox problems. Temperatures to 150° F and suction pressures to 75 psi can be handled. Quick delivery.

APPLICATIONS:

- *Air conditioning*
- *Marine*
- *Swimming pools*
- *Building service*
- *Refrigeration*
- *Coolant oil*
- *Car washing*
- *Fire protection*
- *and countless other general purpose pumping jobs*

Byron Jackson Co. PUMP DIVISION

P.O. Box 2017, Terminal Annex
Los Angeles 54, California

Quality Pumps Since 1872

MEETINGS & CONVENTIONS

Continued

I-B-R SCHOOL OF MODERN HEATING—conventional type of three-day schools will be continued during September as well as the first week of October. During the rest of October and in November an intensive one-day course on baseboard series loop installations will be given. Three-day schools are: September 21-23, Nashville, Tenn.; September 28-30, Winston-Salem, N.C.; October 5-7, Charlotte, N.C. One-day courses are: October 19, Baltimore, Md.; October 21, Washington, D.C.; October 26, Long Island, N.Y.; October 28, Brooklyn, N.Y.; November 9, White Plains, N.Y.; November 11, Poughkeepsie, N.Y.; November 16, Utica, N.Y.; November 18, Syracuse, N.Y.

Tuition for the one-day baseboard course is $10. Further information may be obtained by writing to the new headquarters of the Institute of Boiler and Radiator Manufacturers, 608 Fifth Ave., Room 408, New York City.

AMERICAN WELDING SOCIETY, 33 W. 39th St., New York 18—national fall meeting, November 1-5, Sherman Hotel, Chicago. Among the subjects to be discussed are the welding of titanium, zirconium and molybdenum, the use of welding in the production of

All working parts on COVER
ADSCO
of ADSCO DUAL STEAM TRAP

Only ADSCO's exclusive features make maintenance so easy. There's no breaking of pipe connections to inspect or service the trap, because all working parts are mounted on the cover. An extra cover assembly becomes a complete spare trap . . . replace the cover in a matter of minutes, service the original, and the result is a spare trap always ready.

ADSCO traps offer additional exclusive advantages: reversible stainless steel valve and seat double the life of the trap . . . inlet and outlet connections on *both* sides make installation easy and less expensive. Write today for catalog data.

AMERICAN DISTRICT STEAM COMPANY, INC.

GENERAL OFFICES
NORTH TONAWANDA, NEW YORK
PLANTS: NORTH TONAWANDA, N. Y., AND RICHMOND, CALIF.

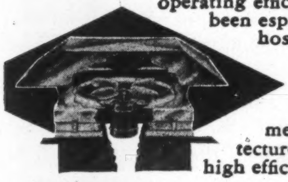
MATCH THE MIRACLE OF MODERN BUILDING

WITH THE NEW

LO-SIL

POWER ROOF VENTILATORS

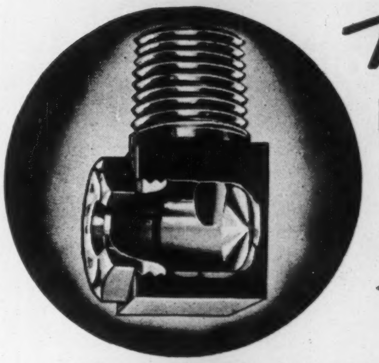
Here's functional beauty combined with maximum operating efficiency. The new LO-SIL has been especially designed for schools, hospitals, libraries, churches, restaurants, and commercial buildings. Muckle—the most dependable name in power ventilation meets the new trend in architecture with the low silhouette, high efficiency LO-SIL VENT.



Totally enclosed motor mounted on vibration separators. Easy to install—heavy gauge steel, electric welded, 31 sizes—250 CFM to 17600 CFM.

Write today for Free Application information.

Muckle MANUFACTURING COMPANY
OWATONNA 8, MINN.



Monarch

NOZZLES for AIR WASHERS

←

These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.

Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from 1/8" to 1". 1/4" size is 1-5/16" long and made from 5/8" square stock.

Write for Catalog 6-A

Monarch MFG. WORKS, INC.
2523 E. ONTARIO ST.
PHILADELPHIA 34, PA.

Canadian Agents: (Except B.C.)
Canadian General Filters Ltd., Toronto 16, Canada

SPECIAL
DELIVERY

of the reduced pressure you want!

. . . with this STANDARD valve

Here is a standard diaphragm regulator that can handle your special pressure control requirements. It is furnished in a wide range of sizes, types (self-contained, instrument or pilot control), bodies, and trim, to your specification. For water, oil, steam, air or gas. No. 119 single seated, No. 114 double seated, sizes 1/2" to 6", screwed, standard or extra heavy flanged. Direct or reverse acting. Tested and approved by leading engineers and contractors — the answer to your regulator problems.

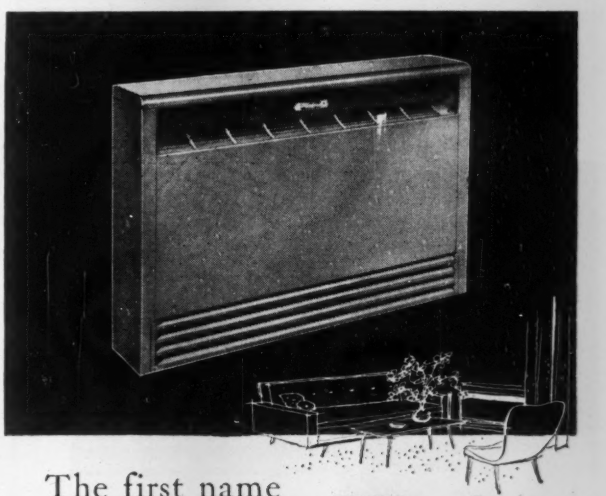
No. 114 & No. 119 REGULATOR

- Pressures to 300 psi reduced to zero.
- Bronze, semi-steel or steel bodies
- Spring loaded, interchangeable diaphragms
- For water, oil, steam, air or gas

WRITE FOR CATALOG NO. 54-F

KECKLEY
pressure regulators • float boxes
temperature regulators
pop safety valves • relief valves
float valves • balanced valves
solenoid valves • strainers

1914 **O. C. KECKLEY CO.** 1954
400 W. Madison Street • Chicago 6, Illinois
40th Anniversary



The first name in heating is still **Modine**
CONVECTOR RADIATION

For those who want modern heating at its finest, there's only one answer — Modine convector radiation. Unmatched performance is combined with quiet beauty . . . long life with uniform, healthful heating. Your choice of enclosure styles for free-standing, recessed or for wall-hung installation.

For complete information, call the Modine representative listed in your classified phone book today. Or write for Bulletin SA-54, Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wisconsin. R-1236

MEETINGS & CONVENTIONS

Continued

aircraft and rockets, welding high temperature materials, inert gas shielded arc welding, resistance welding, and fused metallized coatings.

The meeting will run concurrently with the *NATIONAL METALS EXPOSITION* to be held at the International Amphitheater.

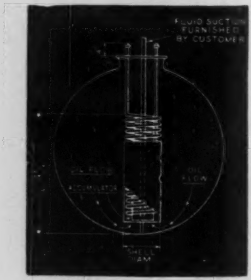
AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 234 Fifth Ave., New York 1—50th annual meeting, Philadelphia, November 28-December 1.

21st *NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING*, under the management of the International Exposition Co., 480 Lexington Ave., New York 17—Commercial Museum, Philadelphia, December 2-7. The dates were arranged during the period of the 74th annual meeting of the *AMERICAN SOCIETY OF MECHANICAL ENGINEERS*, under whose auspices the exposition will be held.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS—fourth annual conference of the Western Region, November 18-19, Hotel Biltmore, Los Angeles.

Solve STORAGE TANK OIL PREHEATING

REMPE "Hot Spot" PREHEATER



All-steel shell and coil assembly for preheating No. 5 and Bunker "C" oils and other liquids to proper flow temperature before they enter the suction pipe. Positive preheating by flow accumulator.

Suction pipe, inlet and outlet pipes for heating by steam or hot water go through manhole cover. Made with 14" or 16" dia. shell.

WRITE FOR DETAILS.

Complete facilities for fabrication of pipe coils — all types — all materials. Engineering service. Send details for price.

HEAT TRANSFER EQUIPMENT
REMPE CO.
Founded 1890

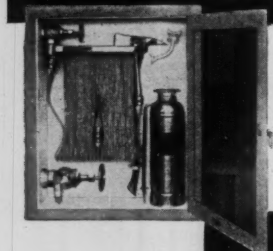
REMPE COMPANY
342 N. Sacramento Blvd., Chicago 12, Ill.

Best for Clients

PROVED RELIABLE, ECONOMICAL

ALLENCO
INTERIOR FIRE-PROTECTION EQUIPMENT

Complete Line — 480 Cabinets Alone
Modern, Most Widely Used

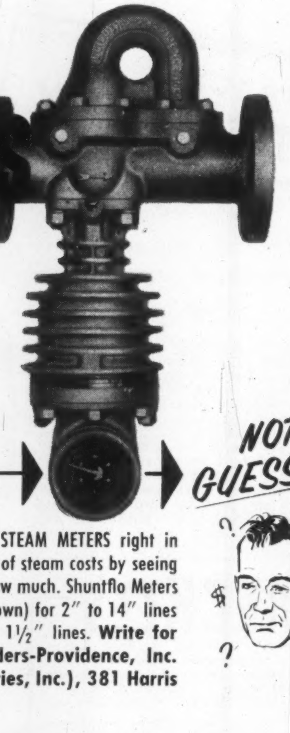


Easiest for you

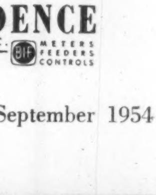
Reliable Delivery—
Goes in Easier

SINCE 1887
W. D. ALLEN
Manufacturing Co.
CHICAGO 6 • NEW YORK 7

pounds



NOT GUESSES



Install BUILDERS SHUNTFLO STEAM METERS right in your steam lines. Keep track of steam costs by seeing where steam is going and how much. Shuntflo Meters available in Model SMKS (shown) for 2″ to 14″ lines — Model SMDH for 1″ and 1½″ lines. **Write for Shuntflo Bulletins. Builders-Providence, Inc. (Division of B-I-F Industries, Inc.), 381 Harris Ave., Providence 1, R. I.**

BUILDERS-PROVIDENCE
DIVISION OF B-I-F INDUSTRIES, INC.
METERS FEEDERS CONTROLS

DEPENDABLE HOT AIR

CHROMALOX *Electric* HEATERS

FOR COMFORT OR PROCESS HEATING

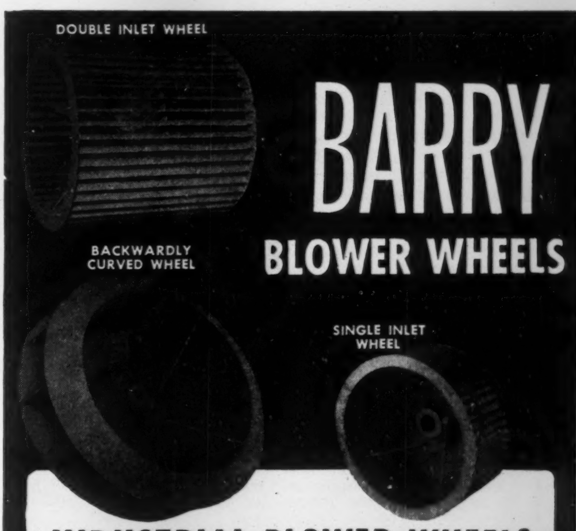
Providing consistent, dependable hot air for space or process heating is simple when you use Chromalox Electric Heaters. Ready-to-use units are available for permanent or portable mounting; or you can build banks of heaters for specialized uses in air ducts, heat exchangers, ovens and other applications. Economical around-the-clock service with minimum maintenance; rapidly reached, accurately controlled temperatures; wide selection to meet specific needs.

FOR MORE KNOW-HOW
Write for Catalog 50 which shows Chromalox Electric Heaters for use in offices, plants and homes.
SB-26

EDWIN L. WIEGAND CO., 7610 THOMAS BOULEVARD, PITTSBURGH 8, PA.

CHROMALOX 1B-97

ELECTRIC HEATING AT ITS BEST!



BARRY BLOWER WHEELS

INDUSTRIAL BLOWER WHEELS BUILT TO YOUR SPECIFICATIONS

Barry blower wheels assure smooth long lasting service. Each wheel precisely built, expertly trued and perfectly balanced by a company manufacturing blower wheels exclusively. Prompt delivery on any type heavy duty industrial blower wheel from 6″ to 72″ diameter. Send your specifications and we shall be pleased to quote immediately. Barry Blower Co., 3100 California St., N.E., Minneapolis 18, Minnesota.

KEYNOTES

"See what I mean about KEY-TITE joints breaking easy?"

The perfect sealer for pipes carrying water, gas, low-pressure steam.

Write for free sample today!

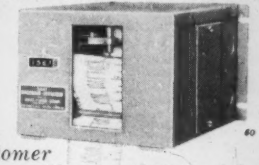
KEY-TITE
WATER PROOF
PIPE JOINT COMPOUND

SEALS TIGHT... BREAKS RIGHT!

A Product of KEY COMPANY
2617 McCasland • East St. Louis, Illinois

makes a record of job performance!

HEAT RECORDER-TOTALIZER



operates on either 115 or 230 volts 60 cycle AC current

Satisfy your customer and yourself that the job is tops!

The HEAT RECORDER-TOTALIZER furnishes all the data you could get watching the heating plant 24 hrs.-a-day with stopwatch, pad, pencil and adding machine.

In addition to marking on a chronological tape the time the heat went on, how long it was on, when it went off, etc., the HEAT RECORDER-TOTALIZER adds up on the totalizer meter the total "ON" time.

No chart to change daily! One tape roll lasts almost a heating season. The HEAT RECORDER-TOTALIZER operates electrically — in any plant, large or small. Use it from job to job — or better yet, make it part of the installation . . . it's priced so low!

Assures intelligent and efficient plant operation. Saves its cost many times in fuel, repairs, maintenance!

$55. TRADE PRICE

write for detailed literature A
HEAT-TIMER *corporation*
657 Broadway, New York 12, N. Y. AL 4-5380

Mfrs. of HEAT-TIMER electronic controls, Heat Recorder+Totalizer, Thermovalve, Varivalve, Motorized Valves, Smoke-Eye Smoke Alarm, Fire-Chief Fire Alarm

STAXAUSTER can be used to convert all types of roof ventilators into powerful exhaust or air supply units.

Allen

EXHAUST FANS

Whether you are working on new construction or motorizing existing ventilators, Allen Exhaust Fans will be the top-performance, quality answer to the particular ventilating problem. Easy to install, economical to operate, these fans meet a wide range of needs. In addition to the Fan Section shown above, the line includes the Remote Drive Allen Staxauster, and for wall installations, the Allen Exhaust Fan and the Lo-Noiz-Level Multiblade Fan. Our representatives are in most principal cities; names listed in our catalog in Sweet's Architectural File, Section 20b.

Remote Drive Allen Staxauster
Specially designed for applications handling corrosives and/or high-temperature air.

Write for catalog.

ALLEN ENGINEERED VENTILATION

ALLEN COOLER & VENTILATOR INC.
ROCHESTER, MICH.
Roof Ventilators for Every Commercial and Industrial Need

YOU make the
Heating and Air Conditioning Equipment
CORNISH makes the
WIRED ASSEMBLIES
to speed up your production

Through integrated engineering and production control from rod mill to molding, we produce complete QUALITY units at lower cost ———

"MADE BY ENGINEERS FOR ENGINEERS"

CORNISH-RUTLAND COMPANY
Rutland, Vermont

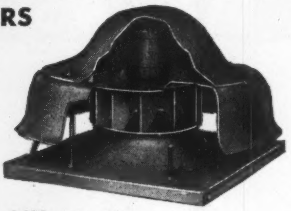
MEETINGS & CONVENTIONS

Continued

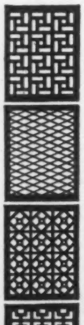
The conference will follow a short course at the University of California. Technical sessions include marine and steel water pipe corrosion problems and the uses of concrete and bituminous coatings on water piping. Registration chairman is J. G. Kerr, C. F. Braun & Co., 1000 S. Fremont Ave., Alhambra, Calif.

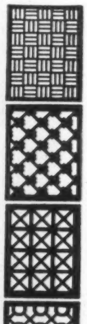
AMERICAN SOCIETY OF HEATING & VENTILATING ENGINEERS, 62 Worth St., New York 13—61st annual meeting, January 24-27, 1955, Benjamin Franklin and Bellevue-Stratford Hotels, Philadelphia.

INTERNATIONAL HEATING & VENTILATING EXPOSITION—The Air Conditioning Exposition, January 24-28, 1955, Commercial Museum & Convention Hall, Philadelphia. Under the auspices of the American Society of Heating and Ventilating Engineers, and under the management of the International Exposition Co., 480 Lexington Ave., New York 17. Equipment on view will demonstrate every known method of moving and conditioning air, as well as engineering materials and mechanical components in the heating, ventilating and air conditioning fields.



AirXpeler POWERED and NON POWERED
ROOF EXHAUSTERS
Direct or Belt Drive
All Having
SIMILAR OUTWARD APPEARANCE
Low in Silhouette
Built to Outlast Buildings
See Sweet's or send for Bulletin 100 E
C. L. Ammerman Co.
110 No. 2nd ST.
Minneapolis 1, Minn.





DIAMOND
TRADE MARK
GRILLES

Look Better — Last Longer

Superior workmanship and finish in heavy-gauge metal assures installations of lasting beauty. Most designs stamped in any thickness, up to one-fourth inch, from any metal. Catalog No. 36 illustrates all designs and gives complete working data. Free on request.

Diamond Manufacturing Co.
Box 45 Wyoming, Pa.
Sales representatives in all principal cities

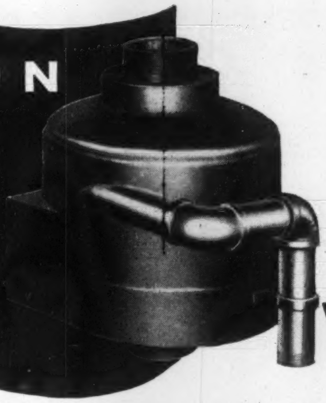
WILSON

CENTRIFUGAL

BLOWDOWN

SEPARATORS

Write for Bulletin 30. Gives complete details and simple installation diagrams.



Solve Blowdown Problems

—NO TANKS NEEDED!

Wilson Centrifugal Blowdown Separators permit direct drainage of boiler blowdown to sewer, or other disposal, at atmospheric pressure. Flash steam and pressure are relieved through a large vent without entrapped water or objectional noise.

Installation of separators can be made wherever convenient—at the boiler, on boiler house roof, or outside the boiler house walls. Size of boiler blowdown connection determines which of two models (shown in Bulletin 30) is required. Separators are used, instead of blowdown tanks, in 47 states, foreign countries, and overseas military bases.

WILSON ENGINEERING CORPORATION

122 So. Michigan Ave., Dept. H-9, Chicago 3, Ill.

UNUSUAL OPPORTUNITY FOR AN

EXPERIENCED ESTIMATOR

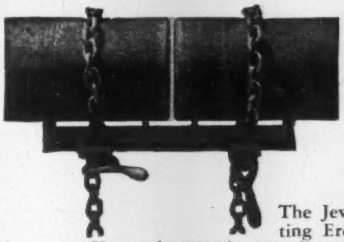
with a long-established, prominent New York City contractor

Must be experienced in heating, ventilating, and air-conditioning engineering. Please write, stating salary requirement and all pertinent information.

Replies held in strict confidence.

Box 1114A, Heating, Piping and Air Conditioning
6 No. Michigan Ave., Chicago, Ill.

PIPE WELDING TOOLS THAT MAKE WELDING PAY



Pipe Clamps
Flange Clamps
Elbow Clamps
Angle Clamps
Pipe Markers

TWO SIZES
½ to 8 in. 8 to 16 in.
Light—Adjustable—Fast

The Jewel System of Pipe and Fitting Erection Ready for the Weld
Keeps the Welder Welding Instead of Waiting
CUTS ERECTION COSTS
Modernize Your Own Methods and Tool Equipment

JEWEL MANUFACTURING COMPANY
1841 University Ave., St. Paul, Minn.

CLASSIFIED ADVERTISING

Classified Section: Rates for classified advertising are 15 cents for each word, including heading and address. One inch $7.00. Count nine words for keyed address. Minimum $2.50 for each insertion. Cash must accompany order.

situations open . . .

AIR CONDITIONING ENGINEERS—Opportunity with major manufacturer, midwest location. Application engineering and training work in rapidly expanding year around residential field. Several positions to be filled cover range of experience and salary. Our employees know of this ad. Address Key 1115A, Heating, Piping & Air Conditioning, 6 North Michigan Avenue, Chicago 2, Ill.

Would like to interview personally or discuss in letter, year-around position for Air Conditioning mechanic on Freon 12 and 22, preferably not over forty years old, with a background of both theory and practical knowledge. FORREST SHOEMAKER AIR CONDITIONING CO., 1136 S. Peoria, Tulsa, Oklahoma.

miscellaneous . . .

NAMEPLATES — SPECIALLY manufactured for air conditioning and refrigeration requirements. Use these low cost 2-½"x ¾" metal nameplates for labeling and identifying your installations. Over 100 standard refrigeration and air conditioning wordings available for immediate shipment. No. minimum order required. Free samples, quotations. SETON NAME PLATE CO., Dept. M, 394 Central Ave., New Haven, Conn.

agents wanted . . .

AGENTS WANTED—Exclusive territorial franchises Peoria-Springfield, Illinois area; South Bend, Kalamazoo, Grand Rapids, Michigan Area; Montana and British Columbia available for established representatives handling our heating and ventilating units, air conditioners, heating and cooling coils, unit heaters, other heat transfer products. A leader in the industry for over 20 years. McQuay, Inc., 1600 Broadway, N.E., Minneapolis 13, Minnesota.

Manufacturer's Agents required by well known manufacturer of STEAM, GAS AND OIL FIRED UNIT HEATERS. HEATING AND VENTILATING UNITS. CONVECTOR RADIATORS. Territories open in several sections of the United States. Airtherm Manufacturing Company, 711 South Spring Avenue, St. Louis 10, Missouri.

lines wanted by mfrs. agent . . .

Do you need concentrated full time coverage in the Rockford-Freeport (Illinois) and Beloit, Janesville, Madison (Wisconsin) trading areas? I can give you the advantage of a proven pre and postwar sales record. Experience in sales of heating and cooling coils, unit, radiation, unit heaters (Steam and gas) and specialties in commercial and industrial heating as well as residential heating equipment. Address Key 1113A, Heating, Piping & Air Conditioning, 6 North Michigan Avenue, Chicago 2, Ill.

lines wanted . . .

Well established manufacturers representative covering Indiana with Indianapolis office desires additional heating and ventilating lines. Gas unit heaters, copper baseboard radiation, fans etc. preferred. Address Key 1116A, Heating, Piping & Air Conditioning, 6 North Michigan Avenue, Chicago 2, Ill.

Manufacturers' representative selling all plumbing and heating jobbers in Michigan and Northern Ohio — needs one or two good lines, prefer some turnover at present. 18 years of successful sales — 75% of my time can be given to new lines. Commission or otherwise. Address Key 1117A, Heating, Piping & Air Conditioning, 6 North Michigan Avenue, Chicago 2, Ill.

business opportunity . . .

SALE OR MERGER—Fast growing N.E. Mfgr. of own brand name convector and baseboards, Yearly gross over $400,000. Address Key 1112A, Heating, Piping & Air Conditioning, 6 North Michigan Avenue, Chicago 2, Ill.

INDEX TO ADVERTISERS

Firms represented in this Issue are identified by the folio of the page on which their advertising appears. Advertising which appears in other issues is marked with an asterisk.

A-J Mfg. Co. 284
Acme Industries, Inc. 72
Aerofin Corp. .... *
Aerovent Fan Co., Inc. .... *
Air Devices, Inc. 65
Air-Factors, Inc. 204
Air-Maze Corp. .... *
Air & Refrigeration Corp. .. *
Airtemp Div., Chrysler Corp. 68
Airtherm Mfg. Co. 46
Aladdin Heating Corp. 226
Alco Valve Co. 9
Aldrich Co. .... *
Allen-Bradley Co. 56
Allen Mfg. Co., W. D. 302
Allen Cooler & Ventilator Inc. 304
Allis-Chalmers Mfg. Co. 52
Allis Co., Louis 192
American Air Filter Co., Inc. 45
American Blower Corp. 44
American Brass Co., The 175, 184
American Dist. Steam Co., Inc. 300
American Gilsonite Co. 211
American-Marsh Pumps, Inc. 280
American Metal Hose Branch, American Brass Co., The .. 184
American Radiator & Standard Sanitary Corp. 177
Ames Iron Works 58
Ammerman Co., C. L. 304
Anderson Co., V. D. 210
Anemostat Corp. of America . *
Armstrong Cork Co. .... *
Armstrong Machine Works .. 73
Aurora Pump Co. 277

Babcock & Wilcox Co., Tubular Prod. Div. 76
Badger Manufacturing Co. .. *
Baldwin-Hill Co. 19
Barber-Colman Co. 43
Barry Blower Co. 303
Bayley Blower Co. 74
Bear Mfg. Co. 298
Bell & Gossett Co. 215
Bethlehem Steel Company .. *
Bigelow Co., Inc. .... *
B-I-F Industries Inc. 302
Binks Mfg. Co. 59
Bishop & Babcock Mfg. Co. . *
Bituminous Coal Institute ... 42
Black & Decker Mfg. Co., The *
Black, Sivalls & Bryson, Inc. *
Blackmer Pump Co. 295
Blaw-Knox Co. 265
Boiler Engrg. & Supply Co. .. *
Bridgeport Brass Company .. 191
Brown Products Co. .... *
Brundage Co., The 202
Bruner Corp., The .... *
Brunner Mfg. Co. 247
Bryant Heater Div., Affiliated Gas Equipment Co., Inc. .. *
Buffalo Forge Co. 30
Buffalo Pumps, Inc. 174
Builders-Providence, Inc. 302
Bundy Tubing Co. .... *
Burnham Corporation 63
Bush Mfg. Co. 4
Byers Co., A. M. .... *
Byron Jackson Company ... 300

Campbell Heating Co. 75
Canton Stoker Corp. 276
Carnes Co., W. R. 212, 295
Carrier Corp. 265
Carver Pump Co. .... *
Cash Co., A. W. .... *
Century Electric Co. 11
Chase Brass & Copper Co. .. 40
Chester Cable Corp. 275
Chicago Blower Corp. .... *
Chicago Pump Co. 176
Clarage Fan Co. .... Inside Back Cover
Cleaver-Brooks Co., Boiler Div. *
Cleveland Fuel Equipment Co. 254
Combustioneer Div., Steel Products Eng. Co., The .. 288
Combustion Eng., Inc. 53
Committee on Steel Pipe Research American Iron & Steel Institute .... *
Connor Engrg. Corp., W. B. 69
Continental Air Filters, Inc. . 185
Cooper Alloy Foundry Co. .. *
Copeland Refrigeration Corp. . *
Copper & Brass Research Association 217
Cornish Rutland Co. 304
Crane Co. 18
Crocker-Wheeler Div., Elliott Co. .... *
Curtis Refrigerating Machine Div. of Curtis Mfg. Co. 27
Cyclotherm Div., U. S. Radiator Corp. 255

Davis Eng. Corp. 292
De Bothezat Fans Division, American Machine & Metals 241
DeLaval Steam Turbine Co. .. 50
Delco Prods. Div., General Motors Corp. .... *
Delta Heating Co. 261
Detroit Controls Corp. 31
Detroit Stoker Co. .... *
Devices, Inc. .... *
Diamond Mfg. Co. 304
Dodge Mfg. Co. 38
Dole Refrigerating Co. .... *
Dole Valve Company 235
Dollinger Corp. .... *
Dravo Corp. 263
Drayer-Hanson, Inc. 267
Dunham Co., C. A. 25
Duriron Co., Inc., The 287
Dunkirk Radiator Corp. .... *
Duro-Dyne Corp. .... *

Eagen Co., Inc., Walter H. .. 283
Eclipse Fuel Eng. Co. .... *
Economy Pumps, Inc., Div. of C. H. Wheeler Mfg. Co. .. *
Electric Auto-Lite Co., Instrument and Gauge Div. 289
Electro-Dynamic Div. of General Dynamics Corp. 213
Electromode Corp. .... *
Elgen Mfg. Corp. .... *
Emerson Elec. Mfg. Co., The *
Evans Corp., The George 220, 221
Everlasting Valve Co. 279

Fairbanks Co., The 271
Fairbanks, Morse & Co. 48
Fairmont Aluminum Co. .... *
Farrar & Trefts Inc. 260
Farris Stacon Corp. 252
Farr Co. .... *
Fedders-Quigan Corp. 181
Field Control Div., H. D. Conkey & Co. 278
Firestone Plastics Co. .... *
Fisher Governor Co. .... *
Fitzgibbons Boiler Co., Inc. .. 171
Flexaust Company .... *
Flexonics Corp. .... *
Fostoria Pressed Steel Corp. *
Frick Co. 272
Fulton Sylphon Div., Robertshaw-Fulton Controls Co. .. 6
Furnas Electric Co. 210

G. & O. Mfg. Co., The 296
Gallaher Co., The 178
General Blower Co. .... *
General Chemical Division, Allied Chemical & Dye Corp. *
General Controls Co. 218
General Electric Co. .. 80, 81, 206
General Fittings Co. 246
Glass Fibers, Inc. 188
Gordon & Piatt .... *
Goulds Pumps, Inc. .... *
Governair Corp. .... *
Grabler Mfg. Co., The 224
Greenlee Tool Co. 273
Grinnell Co., Inc. .... Inside Front Cover
Gustin-Bacon Mfg. Co. .... *

Halstead & Mitchell 33
Handy & Harman 60
Hartwell & Son, Inc., H. N. . *
Hayes Furnace Mfg. & Supply Co. 64
Heat-Timer Corp. 303
Hendrick Mfg. Co. 275
Henry Valve Co. .... *
Hoffman Specialty Mfg. Corp. 32
Howell Electric Motors Co. .. *
Hussey & Co., C. G. .... *

Ilg Electric Ventilating Co. .. *
Illinois Engineering Co., Div. of American Air Filter Co. . *
Illinois Testing Laboratories . 264
Industrial Sound Control, Inc. 263
Independent Register Co., The 256
Infra Insulation, Inc. 239
Ingersoll-Rand Co. .... *
Iron Fireman Mfg. Co. .... *

Janitrol Heating & Air Conditioning Div., Surface Combustion Corp. 250
Jenkins Bros., Inc. 236
Jenn-Air Co., Inc. 270
Jewel Mfg. Co., Inc. 305
Johns-Manville 269
Johnson Co., S. T. .... *
Johnson Service Co. .... Outside Back Cover
Joy Mfg. Co. 207

Kathabar Div., Surface Combustion Corp. 251
Kawneer Co., The .... *
Keasbey & Mattison Co. ... *
Keckley Co., O. C. 301
Kennard Corp. 35
Kewanee-Ross Corp. 47
Key Co. 303
Klipfel Valves Div. of Hamilton-Thomas Corp. .... *
Koppers Co., Inc. 290
Korfund Co., Inc., The 293
Kramer Trenton Co. 281
Kritzer Radiant Coils, Inc. .. 201

Ladish Co. .... *
La Favorite Rubber Mfg. Co. *
Lau Blower Co. 230
Leslie Co. 36
Lewin-Mathes Company 195
Libbey-Owen-Ford Glass Co., Fiber Glass Division .... *
Lincoln Electric Co., The .... *
Liquidepth Indicators, Inc. .. 277
Lunkenheimer Co. .... *

Maid-O'-Mist, Inc. .... *
Manning & Lewis Eng. Co. .. 249
Marley Co., The .... *
Marlo Coil Co. 39
Marsh Heating Equipment Co. 194
Marvel Engineering Co. .... *
McAlear Mfg. Co. 262
McCord Corp. .... *
McDonnell & Miller, Inc. 189
McQuay, Inc. .... *
Mercoid Corp., The 297
Mettler Co., Inc., The 266
Mid-Continent Metal Prod. Co. 297
Midwest Piping Company, Inc. 61
Miller Valve Co., Inc. 294
Mine Safety Appliances Co. .. 242
Minerallac Electric Co. 292
Minneapolis-Honeywell Regulator Co. 54, 55
Miracle Adhesives Corp. .... *
Modine Mfg. Co. 37, 301
Monarch Mfg. Works, Inc. .. 301
Muckle Mfg. Co. 301
Mueller Climatrol Div. of Worthington Corp. 248
Multi-Vent Div., Pyle-National Co., The 234
Mundet Cork Corp. 200
Murray Mfg. Co., D. J. .... *

Nash Eng. Co., The 88
National Heater Co., The .. *
National Tube Div., United States Steel Corp. 172
Nelson, Herman Div. of American Air Filter Co., Inc. .. 45
Nesbitt, Inc., J. J. 82
New York Blower Co. 196
Niagara Blower Co., The 273
Nicholson & Co., W. H. 290
Norman Products Co. .... *
Northern Indiana Brass Co. .. *

Ohio Brass Co. 183
Ohio Injector Co., The 34
Olson & Company, Arthur A. 209
Orr & Sembower, Inc. 232
OverHead Heaters Inc. .... *
Owens-Corning Fiberglas Corp. *

Pacific Steel Boiler Div. of United States Radiator Corp. 41
Packless Metal Hose, Inc. .. *
Parker Boiler Mfg. Co., Sid E. *
Paragon Electric Co. .... *
Patterson-Kelley Co., Inc., The 198, 199
Peerless Elec. Co., The 57
Peerless Pump Div., Food Machinery & Chemical Corp. .. 193
Penn Ventilator Co. 279
Perfex Corp. 293
Petro .... *
Phoenix Products Co. 296
Philadelphia Gear Works, Inc. *
Pittsburgh Plate Glass Co., The Fiber Glass Division .. 190
Porter & Co., H. W. 243
Portmar Boiler Co., Inc. .... *
Powell Valves 28
Powers Regulator Co. 70, 71
Prat-Daniel Corp. .... *
Preferred Utilities Mfg. Corp. 13, 253
Pritchard Co. of Calif., J. F. . 29

R-P & C Division American Chain & Cable Co., The .. *
Ramset Fasteners, Inc. 269
Ray Oil Burner Co. .... *
Reading Tube Corp. 179
Register & Grille Mfg. Co. .. 259
Reliance Electric & Eng. Co. 231
Remington Arms Co. 219
Rempe Co. 302
Republic Steel Corp. 208
Revere Copper & Brass, Inc. 87
Reznor Mfg. Co. 286
Ric-wiL Co., The .... *
Ridge Tool Co., The 244
Rigidbilt, Inc. .... *
Robbins & Myers, Inc., Motor Div. .... *
Roberts-Gordon Appliance Corp. 285
Rockwell Co., W. S. 253
Rome-Turney Radiator Co. ... *

Sall Mountain Co. .... *
Sarco Co., Inc. 182
Sarcotherm Controls, Inc. .. 26
Schaub Eng. Co., Fred H. .. *
SelecTemp Div., Iron Fireman Co. .... *
Servel, Inc. 233
Siemon Mfg. Co. 281
Skidmore Corp. 228
Skil Corp. 223
Smith Co., Inc., H. B., The . *
Spang-Chalfant Div. of The National Supply Co. 7
Spence Eng., Inc. .... *
Spencer Heater, Avco Mfg. Corp. .... *
Sporlan Valve Co. 229
Spraying Systems Co. 294
Standard Refrigeration Co. .. *
Stedco Products .... *
Stephens-Adamson Mfg. Co. .. *
Sterling, Inc. 287
Stewart Mfg. Co. 289
Stic-Klip Mfg. Co. .... *
Superior Combustion Industries, Inc. 227
Surface Combustion Corp. 250, 251
Swartwout Co., The 283
Synchronous Flame Inc. .... *

Taco Heaters, Inc. 291
Tapecoat Company, The 274
Taylor Forge & Pipe Works .. 197
Taylor Instrument Cos. 226
Temprite Products Corp. 267
Thrush & Co., H. A. 180
Titus Mfg. Corp. 16, 17
Titusville Iron Works Co., The, Div. of Struthers Wells Corp. .. 203
Tjernlund Mfg. Co. .... *
Toledo Pipe Threading Machine Co. 285
Trane Co., The 14, 15
Trion, Inc. 51
Tube Turns, Inc. 205
Tuthill Pump Co. .... *
Tuttle & Bailey, Inc. 66, 67
Typhoon Air Conditioning Co. *

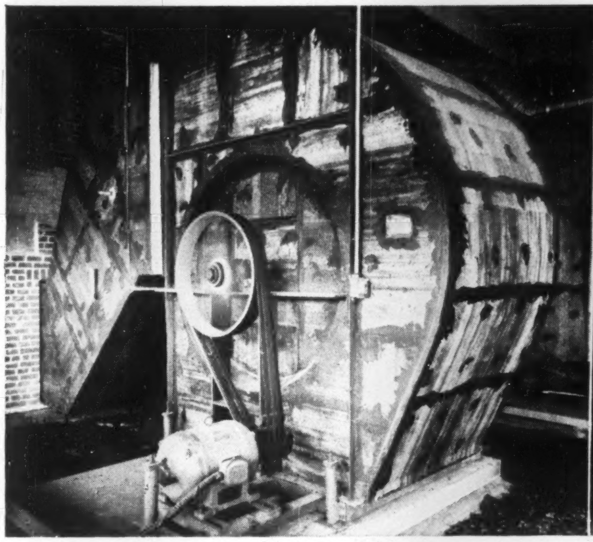
Union Asbestos & Rubber Co. 24
Union Malleable Mfg. Co. .. 187
Unistrut Products Co. .... *
United States Air Conditioning Corp. 3
United States Steel Corp. 21, 49, 172
U. S. Steel Supply Div., United States Steel Corp... 49
Universal Diffuser Corp. 282
Universal Metal Hose Co. .. 300
Utility Fan Corp. 20

Velocity Power Tool Co. 242
Vilter Mfg. Co., The .... *
Vulcan Radiator Co., The .... *

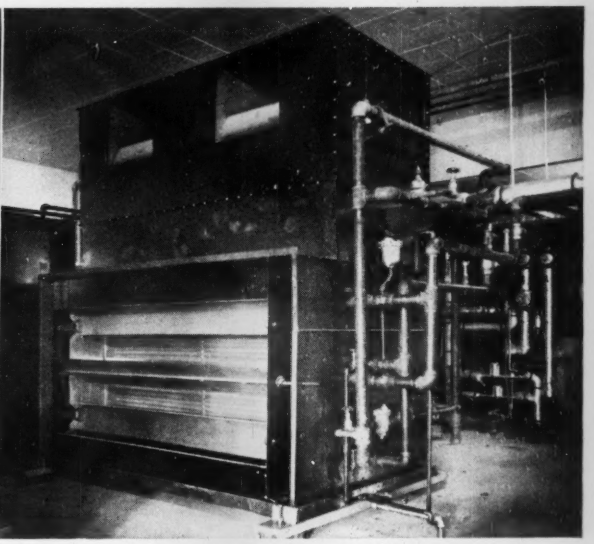
Wagner Electric Corp. 62
Waldron Corp., John 257
Walworth Co. 12
Ward Leonard Elec. Co. .... *
Watson-Stillman Fittings Div., H. K. Porter Co., Inc. 245
Watts Regulator Co. 222
Webster & Co., Warren 79
Webster Engineering Co., The 261
Weil Pump Co. 298
Weinman Pump Mfg. Co. 258
Western Eng. & Mfg. Co. .... *
Westinghouse Electric Corp., Air Conditioning Div. 10
Westinghouse Electric Corp., Sturtevant Div. 173
Wheatland Tube Co. 214
Wheeler Mfg. Co., C. H. .... *
Whitlock Mfg. Co., The .... *
Weigand Co., Edwin L. 303
Will-Burt Company, The 22
Wilson Eng. Corp. 305
Wilson, Inc., Grant 299
Wing Mfg. Co., L. J. 186
Wiremold Co., The 299
Wolverine Tube Div. of Calumet & Hecla, Inc. 216
Worthington Corp. 8

Yarnall-Waring Co. .... *
Yeomans Brothers Co. 271
York Corporation .... *
Young Radiator Co. .... *
Youngstown Sheet & Tube Co. 23
Yula Water Heaters, Inc. .. 268

Zallea Bros. .... *
Zink Co., John .... *
Z-Crete Div., Zonolite Co. .. 225



In its "work clothes" — completely insulated — one of the Clarage Type NH ventilating fans.



One of the Clarage Multitherm air conditioning units on the job — vertical type shown.

Typically Texas

Harris County boasts 2 new Court Houses at Houston. Clarage equipment installed in both!

Not one, but TWO . . . that's the number of Court Houses serving booming Harris County.

Likewise impressive is the amount of Clarage equipment selected for these two installations. In the **new** Harris County Court House: 49 Multitherm Units, 2 Unicoil Units, 22 fans. In the **remodeled** Harris County Court House: 37 Multitherm Units, 20 fans.

You, too, will find it makes sense to choose dependable Clarage equipment. Your inquiry is invited. **CLARAGE FAN COMPANY, Kalamazoo, Michigan.**

The new Harris County Court House at Houston, Texas. ARCHITECT: Finger and Rustay. ENGINEER: I. A. Naman. CONTRACTOR: Charles G. Heyne & Company.

CLARAGE
Air Handling and Conditioning Equipment
Service Manual
for
installation
initial operation
maintenance

YOURS FOR THE ASKING

This 68-page illustrated Service Manual provides valuable information adaptable to virtually any air handling job. Send for your free copy today.

You can Rely on... CLARAGE

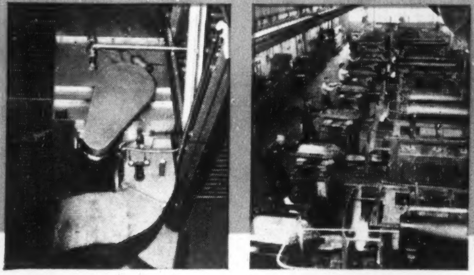
Headquarters for Air Handling and Conditioning Equipment

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

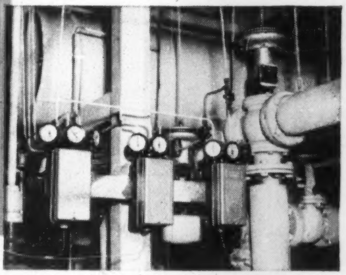
diversified temperature control problems CORRECTLY SOLVED by JOHNSON

Tinnerman Products, Inc., Cleveland, Ohio. McGeorge-Hargett & Associates, architects; Wm. Hargett, mechanical engineer; Feldman Brothers Co., mechanical contractors, all of Cleveland.

In offices, perfect working weather the year 'round is insured by Johnson Room Thermostats which operate mixing dampers on central fan air conditioning units.



Central fan heating and ventilating units in the factory are controlled by Johnson T-316 Insertion Thermostats measuring the temperature of the fan discharge air and operating Johnson Damper Operators on face and bypass dampers.



Weather-compensated Johnson T-901 Submaster Thermostats regulate 3-Way Mixing Valves on the hot water supply for radiant heating coils and convectors.

More than 8,000 shapes and sizes of fastening devices, including famous Speed Nuts, are produced by Tinnerman Products, Inc. Among the many up-to-the-minute facilities designed to insure optimum working conditions in this progressive company's modern plant and office building is a specially planned system of Johnson Automatic Temperature Control.

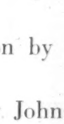
Temperature regulation problems include the control of four central fan air conditioning systems serving the office section and lobby, radiant floor panels in the lobby, hot water convectors in offices and other spaces, and central fan heating and ventilating systems serving manufacturing areas. Each of the varied requirements of the different systems, and the working spaces served by each, is met with precision by properly applied Johnson apparatus.

This installation, like every Johnson System, was planned, made and installed by Johnson to meet the exact needs of the individual control problems encountered, thus insuring the desired results at the lowest possible operating cost.

Any building—small or large, new or existing—can enjoy the superior comfort and economy features of Johnson Control. Ask an engineer from a nearby Johnson branch to make a survey of your problem. He will gladly submit recommendations without obligation. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

JOHNSON CONTROL

TEMPERATURE ⇅ AIR CONDITIONING



PLANNING • MANUFACTURING • INSTALLING • SINCE 1885